```
     1          000000                      .REPT   0
     2
     3
     4
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     6
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    10
    11
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    13
    14
    15
    16
    17                                              IDENTIFICATION
    18                                              --------------
    19
    20                                      PRODUCT CODE:                   AC-8877J-MC
    21
    22                                      PRODUCT NAME:                   CZKWBJ0 KW11-P RT CLK TST
    23
    24                                      PRODUCT DATE:                   1-MAY-78
    25
    26                                      MAINTAINER:                     DIAGNOSTIC ENGINEERING
    27
    28                                      AUTHOR:                         JOHN RODENHISER/JIM LACEY
    29
    30
    31                                      REVISED BY:                     W.F.KELLICKER   AUG 30,1974
    32                                                                      A.J.COSSETTE    NOV.21,1975
    33                                                                      M. SOARES       NOV.21,1975
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    35                                                                      W. SCHLITZKUS   MAY.01,1978
    36
    37
    38                              THE INFORMATION IN THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT
    39                              NOTICE AND SHOULD NOT BE CONSTRUED AS A COMMITMENT BY DIGITAL
    40                              EQUIPMENT CORPORATION. DIGITAL EQUIPMENT CORPORATION ASSUMES NO
    41                              RESPONSIBILITY FOR ANY ERRORS THAT MAY APPEAR IN THIS DOCUMENT
    42
    43                              NO RESPONSIBILITY IS ASSUMED FOR THE USE OR RELIABILITY OF
    44                              SOFTWARE ON EQUIPMENT THAT IS NOT SUPPLIED BY DIGITAL OR ITS
    45                              AFFILIATED COMPANIES.
    46
    47                              COPYRIGHT (C) 1972, 1978 BY DIGITAL EQUIPMENT CORPORATION
    48
    49                              THE FOLLOWING ARE TRADEMARKS OF DIGITAL EQUIPMENT CORPORATION:
    50
    51                              DIGITAL         PDP             UNIBUS          MASSBUS
    52                              DEC             DECUS           DECTAPE
    53
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```
                        1.0     ABSTRACT

                                THIS PROGRAM TESTS THE KW11-P REAL TIME CLOCK.  IT CONTAINS
                                A SERIES OF INCREMENTAL ROUTINES THAT TEST THE CONTROL AND
                                STATUS REGISTER, COUNT SET BUFFER, COUNTER, AND INTERRUPT VEC-
                                TOR ADDRESS USING 100KHZ, 10KHZ, LINE AND
                                EXTERNAL FREQUENCIES.

                        2.0     REQUIREMENTS
                        2.1     EQUIPMENT

                                PDP-11 WITH KW11-P

                        2.2     STORAGE

                                THIS PROGRAM OCCUPIES MEMORY FROM 0 TO 11636.

                        3.0     LOADING PROCEDURE
                        3.1     METHOD
                                PROCEDURE FOR NORMAL BINARY TAPES SHOULD BE FOLLOWED
                                1.  ABSOLUTE LOADER MUST BE IN MEMORY.
                                2.  PLACE BINARY TAPE IN READER.
                                3.  LOAD ADDRESS *7500 (* DETERMINED BY LOCATION OF LOADER).
                                4.  PRESS "START" (PROGRAM WILL LOAD).

                        4.0     STARTING PROCEDURE
                        4.1     CONTROL SWITCH SETTINGS

                                SET SW0=1 TO ENABLE TESTS USING EXTERNAL FREQUENCY.
                                SET SW2=1 TO INCLUDE REPEATABILITY TEST T25 & T26 IF COW IS PRESENT

                        4.2     STARTING ADDRESSES

                                200 BASIC TEST
                                204 RESTART ADDRESS-PRIMARILY USED BY XOR TESTER
                                210 TIMING TEST
                                214 DOUBLE OR SINGLE REAL TIME CLOCK TEST. 100KHZ.
                                220 DOUBLE OR SINGLE REAL TIME CLOCK TEST. 10KHZ.
                                224 DOUBLE OR SINGLE REAL TIME CLOCK TEST. 60HZ.
                                230 DOUBLE OR SINGLE REAL TIME CLOCK TEST 50HZ

                        4.3     PROGRAM AND/OR OPERATOR ACTION
                        **NOTE: IF NO HARDWARE SWITCH REGISTER IS AVAILABLE THE PROGRAM WILL
                                AUTOMATICALLY USE THE CONTENTS OF LOC. 176 AS THE SOFTWARE SWITCH REGISTER.
                                THE USER SHOULD SET UP THIS LOC. BEFORE STARTING THE PROGRAM.

                                LOAD PROGRAM INTO MEMORY
                                SET SWITCH REGISTER TO STARTING ADDRESS
                                LOAD ADDRESS.
                                IF DESIRED TO ENABLE EXTERNAL FREQUENCY TESTS SET SW0=1.
                                PRESS START
                                PROGRAM WILL BEGIN TESTING


                        5.      OPERATING PROCEDURE
```

```
                        5.1     OPERATIONAL SWITCH SETTINGS
                        5.1.1   BASIC TEST

                                WITH SWITCHES 12 THRU 15=0 (DOWN) THE PROGRAM WILL PRINT OUT
                                ON ERRORS AND CONTINUE IN TEST.  BELL WILL RING AT COMPLETION
                                OF A PASS.

                                SWITCH SETTINGS ARE:
                                SW15=1 OR UP...HALT ON ERROR
                                SW14=1 OR UP...SCOPE LOOP
                                SW13=1 OR UP...INHIBIT PRINTOUT
                                SW11=1 OR UP...SINGLE ITERATIONS ONLY
                                SW4 =1 OR UP...ENABLE SYNCHRONIZATION TESTS
                                SW3 =0 OR DOWN...ADJUSTS DELAYS FOR 11/60, 11/70 OR 11/45 WITH MOS OR BIPOLAR ME
                                SW2 =1 OR UP...CLK2 PRESENT-EXECUTE REPEATABILITY TESTS

                        5.2     SUBROUTINE ABSTRACTS

                        5.2.1   SCOPE

                                THIS SUBROUTINE CALL IS PLACED BETWEEN EACH SUB-TEST IN THE
                                BASIC TEST SECTION.  IT RECORDS THE STARTING ADDRESS OF EACH
                                SUB-TEST AS IT IS BEING ENTERED.  IF A SCOPE LOOP IS REQUESTED,
                                IT WILL JUMP TO THE START OF THE SUB-TEST INDICATED BY "SCOPE".

                        5.2.2   HLT

                                THIS SUBROUTINE CALL PRINTS THE ADDRESS THAT TAGS THE FAILING
                                SUB-TEST AND THE CONTENTS OF THE CONTROL AND STATUS REGISTER,
                                COUNTER, AND "TEMP".


                        6.      ERRORS
                        6.1     ERROR PRINTOUT FORMAT

                                WITH SW13=0 (OR DOWN) THE FOLLOWIG PRINTOUT WILL APPEAR ON
                                AN ERROR:

                                  PC    STATUS  COUNTER  TEMP
                                XXXXXX  XXXXXX  XXXXXX  XXXXXX

                                PC      = ADDRESS OF TEST WHERE ERROR OCCURRED
                                STATUS  = CONTENTS OF COMMAND AND STATUS REGISTER AT TIME OF ERROR
                                COUNTER = CONTENTS OF COUNTER AT TIME OF ERROR
                                TEMP    = CONTENTS OF ADDRESS "TEMP" USED BY SOME TESTS.

                                NOTE:  NOT ALL OF THE INFORMATION PRINTED IS INTENDED
                                       TO BE USEFUL FOR EVERY TYPE OF ERROR.  THIS IS SIMPLY
                                       A STANDARD ERROR REPORT FOR ALL ERRORS.  THE OPERATOR
                                       MUST REFER TO THE PROGRAM LISTING AT THE ADDRESS OR
                                       THE ERROR FOR A DESCRIPTION OF THE CAUSE OF THE ERROR.

                        6.2     ERROR RECOVERY

                                WITH SWITCH 15=1 (OR UP) THE PROGRAM WILL HALT ON AN ERROR.
                                DEPRESS "CONTINUE" TO RESUME TESTING.
```

```
166
167                          7.      RESTRICTIONS
168
169                          7.1     OPERATIONAL RESTRICTIONS
170
171                                  FOR PURPOSES OF TESTING THE EXTERNAL FREQUENCY SELECTION IT
172                                  IS NECESSARY TO SUPPLY A KNOWN FREQUENCY TO THE EXTERNAL FRE-
173                                  QUENCY INPUT. THIS PROGRAM USES THE INTERNAL 60HZ FOR ITS
174                                  SOURCE.  TO DO THIS IT IS REQUIRED THAT A JUMPER WIRE BE CON-
175                                  NECTED BETWEEN PINS CF1 AND DA1 OF THE SLOT IN WHICH THE CLOCK
176                                  MODULE IS INSERTED.  IF THIS IS NOT DONE, THEN THE PROGRAM MUST
177                                  ALWAYS BE RUN WITH SW0=0 TO SUPPRESS THE EXTERNAL TESTS.
178                                  * IF A SECOND P CLOCK IS BEING USED FOR TEST PURPOSES, SET
179                                    THE SWITCH REG = 000004 TO ENABLE TESTS T25 AND T26, DURING
180                                  THE BASE TEST
181
182                          8.      MISCELLANEOUS
183
184                          8.1     EXECUTION TIME
185
186                                  BASIC TEST REQUIRES 11 SECONDS PER PASS W/O ITERATIONS 66 WITH.
187                                  TIMING TEST REQUIRES 4 MINUTES PER PASS.
188                                  DOUBLE OR SINGLE REAL TIME CLOCK TEST-DETERMINED BY OPERATOR
189                                  SUGGESTED EXECUTION TIMES ARE:
190                                  1.  IF THE SINGLE CLOCK TEST IS RUN WITHOUT BEING FOLLOWED
191                                      BY THE DUAL CLOCK TEST: 17 MINUTES FOR EACH FREQUENCY (100KHZ,10KHZ,60KHZ)
192
193                                  2.  IF THE SINGLE CLOCK TEST IS FOLLOWED BY THE DUAL TEST
194                                      RUN SINGLE CLOCK TEST FOR ONE MINUTE (FOR EACH FREQUENCY)
195                                      RUN DUAL CLOCK TEST FOR FIFTY SECONDS (10 PRINTOUTS) (FOR EACH FREQUENCY)
196
197
198
199                                  NOTE:THIS TIME NOMINAL TIME FOR PDP-11/05
200                                         OTHER C.P.U.'S THE TIME WILL VARY
201
202
203                          9.      PROGRAM DESCRIPTION
204
205                                  THE PROGRAM CONSISTS OF THREE SECTIONS:  THE BASIC TEST  THE
206                                  TIMING TEST AND THE REAL TIME CLOCK TEST.  THE BASIC TEST CHECKS EACH OF
207                                  THE INDIVIDUAL BITS IN THE CONTROL AND STATUS REGISTER, COUNT SET BUFFER, AND
208                                  COUNTER ALONG WITH PROPER OPERATION UNDER INTERRUPT CONTROL
209                                  (SINGLE OR REPEATED INTERRUPTS) COUNT UP OR COUNT DOWN, AND
210                                  REPEATABILITY.  THE TIMING TEST USES ALL CLOCK FREQUENCIES TO
211                                  RING THE TELETYPE BELL AT 10 SECOND INTERVALS.
212                                  THE CLOCK TEST PROVIDES A REAL TIME CLOCK
213                                  WHOSE ACCURARCY CAN BE MEASURED AGAINST AN
214                                  ACCURATE EXTERNAL SOURCE.
215
216                          9.1     BASIC TEST
217
218                                  TEST            DESCRIPTION
219
220                                  T0 THRU T9      TEST THAT CSR, COUNT SET BUFFER AND COUNTER
221                                                  BITS MAY BE SET AND CLEARED.
```

```
                        T10 THRU T11    TEST FIX(BIT5) TO SINGLE CLOCK COUNTER.

                        T12 THRU T15    TEST CLOCK TO COUNT UP.

                        T16 THRU T19    TEST CLOCK TO COUNT DOWN.

                        T20 THRU T24    TEST INTERRUPT MODES.

                        T25 THRU T26    TEST REPEATABILITY BY CHECKING THAT THE COUNTER
                                        CONTAINS THE SAME NUMBER OF COUNTS OVER TWO
                                        EQUAL PERIODS OF TIME.

                9.2     TIMING TEST

                        THIS TEST USES THE REPEATED INTERRUPT MODE TO RING THE TELETYPE
                        BELL AT 10 SECOND INTERVALS.  FIRST THE BELL IS RUNG AT 10 SE-
                        COND INTERVALS FOR 1 MINUTE USING 100HKZ, FOLLOWED BY 1 MINUTE
                        AT 10KHZ FOLLOWED BY 1 MINUTE AT LINE FREQ.(60HZ OR 50HZ) AND
                        (IF SW0=1) 1 MINUTE AT LINE FREQ. USING EXTERNAL FREQUENCY
                        INPUT.

                9.3     DOUBLE OR SINGLE REAL TIME CLOCK TEST

                9.3.1   SINGLE CLOCK REAL TIME TEST

                        THE 24 HOUR CYCLE:
                        THIS TEST TRANSFORMS YOUR COMPUTER INTO AN
                        ACCURATE DIGITAL "WALL CLOCK."  A NORMAL
                        CLOCK'S 12 HOUR CYCLE HAS BEEN REPLACED BY
                        A 24 HOUR CYCLE.

                        EXAMPLES OF THE 24 HOUR CYCLE FOLLOW:

                        ACTUAL TIME                     PRINTOUT
                        -----------                     --------
                                                HRS   MINS   SECS   TENTHS+HUNDRETHS OF SECS.
                        MIDNIGHT                00  :  00  :  00  .  00
                        8:32 AM                 08  :  32  :  00  .  00
                        12 NOON                 12  :  00  :  00  .  00
                        2:15 PM                 14  :  15  :  00  .  00
                        11:30 PM                23  :  30  :  00  .  00

                9.3.1.1 ENTERING THE TIME

                        THE CLOCK CAN BE UPDATED BY HOLDING THE CTRL KEY DOWN
                        AND TAPPING THE I KEY.  THE CTRL KEY IS THEN RELEASED,
                        AND THE STARTING TIME IS ENTERED.

                        THE MOST SIGNIFICANT HOUR DIGIT IS ENTERED FIRST.
                        THIS DIGIT MUST BE A ZERO, A ONE OR A TWO.
                        THE LEAST SIGNIFICANT HOURS DIGIT IS ENTERED NEXT FOLLOWED BY
                        THE TWO MINUTES DIGIT, FOLLOWED BY THE TWO SECONDS DIGIT.
                        THE FRACTION OF A SECOND DIGITS ARE NOT ENTERED.  THE
                        USER WILL ENTER A TOTAL OF SIX DIGITS WITH NO SPACES, COLONS,
                        OR ANY OTHER CHARACTERS BETWEEN DIGITS.  THE USER MUST
```

ENTER A TIME THAT WILL OCCUR A HALF MINUTE OR MORE
IN THE FUTURE, TO ALLOW ENOUGH TIME TO ENTER THE REQUIRED
INFORMATION. AFTER THE INFORMATION HAS BEEN ENTERED, THE
USER MONITORS THE TIME STANDARD. WHEN THAT STANDARD REACHES
THE TIME ENTERED VIA THE KEYBOARD, THE USER HITS THE
CARRAGE RETURN (CR) KEY TO START THE CLOCK.
NOTE THAT THE CHARACTERS WILL NOT BE PRINTED
OUT AS THE TIME IS BEING ENTERED.

9.3.1.2 READING THE TIME

TO PRINT THE TIME, DEPRESS THE CTRL KEY. WHILE HOLDING
THE CTRL KEY DOWN, SMARTLY TAP THE T KEY. THE TIME WHICH
CORRESPONDS TO THE INSTANT THAT THE T KEY WAS DOWN, WILL
BE PRINTED OUT. THE FORMAT OF THE PRINTOUT WILL BE SIMULAR
TO THAT SHOWN IN THE 24 HOUR TIME EXAMPLE. THE
ONLY DIFFERENCE WILL BE THE ABSENCE OF SPACES.

9.3.1.3 TIME REFERENCES

SINCE THE SYSTEM CLOCK IS MORE ACCURATE THAN MANY WRIST
WATCHES, IT IS A GOOD IDEA TO USE AN ACCURATE TIME STANDARD.
MANY TELEPHONE COMPANIES PROVIDE A NUMBER WHERE
THE TIME, SYNCHRONIZED TO THE NATIONAL BUREAU OF STANDARDS
RADIO STATION (WWV), IS AVAILABLE. CONSULT WITH YOUR LOCAL
TELEPHONE COMPANY TO SEE IF THIS SERVICE IS AVAILABLE IN YOUR AREA.

9.3.1.4 PROCEDURE FOR SINGLE CLOCK REAL TIME TEST.

1. PERFORM THE BASIC TEST, PRIOR TO THE PERFORMANCE OF
   THIS TEST. PROCEED ONLY IF THE BASIC TEST HAS PASSED.

2. LOAD ADDRESS 214 VIA THE SWITCH REGISTER, (100KHZ TEST)

3. PLACE ALL ZEROS IN SWITCH REG., DEPRESS START

4. EXAMINE YOUR TIME REFERENCE, AND SELECT A TIME THAT
   WILL ALLOW YOU ENOUGH TIME TO ENTER THE TIME VIA THE
   KEYBOARD.

5. ENTER THE TIME, AS DESCRIBED PREVIOUSLY.

6. START THE CLOCK (HIT THE CR KEY) AT THE INSTANT THE
   TIME REFERENCE CORRELATES WITH THE TIME ENTERED.

7. MONITOR YOUR TIME REFERENCE, EXACTLY 1 MINUTE
   FROM THE TIME YOU STARTED THE CLOCK, READ THE PROGRAM
   CLOCK AS DESCRIBED PREVIOUSLY.

8. THE ONE MINUTE TIME ERROR SHOULD BE WITHIN ONE SECOND
   OF THE ACTUAL TIME.

9. IF THE RESULT OF STEP 8 IS NOT WITHIN ONE SECOND,
   ALLOW EXACTLY ONE MORE MINUTE TO PASS (FROM THE ORIGINAL
   START TIME). READ THE TIME AGAIN. IF THE TOTAL ERROR
   DOUBLED, THE BOARD IS DEFECTIVE. IF THE ERROR IS CONSTANT,

```
                        RESTART THE TEST.

                    10.* IF THE ONE MINUTE TEST WAS PASSED, ALLOW THE TEST TO
                        RUN FOR EXACTLY 16 MINUTES MORE.  AT THE EXACT END OF THE
                        16TH MINUTE INTERVAL, READ THE CLOCK.  IT SHOULD
                        BE WITHIN THREE SECONDS OF THE CORRECT TIME.  IF IT IS NOT,
                        THE BOARD IS DEFECTIVE. IN THE EVENT THAT THE DUAL CLOCK
                        REAL TIME TEST IS GOING TO BE PERFORMED, THIS STEP
                        CAN BE OMITTED.

                    11. LOAD ADDRESS 220 VIA SWITCH REGISTER,
                        DEPRESS START (10KHZ TEST)
                        REPEAT STEPS 3-10

                    12. LOAD ADDRESS 224 VIA SWITCH REGISTER,
                        DEPRESS START (224 IF 60HZ, OR 230 IF 50HZ LINE TEST)
                        REPEAT STEPS 3-10


                     *  THE DURATION OF THIS TEST IS ARBITRARY, IT IS NOMINALLY
                        A THOUSAND SECOND TEST.  LONGER TESTS ARE PERMISSIBLE.
                        THE RESULTS OF LONG TERM TESTS SHOULD BE WITHIN (PLUS OR MINUS)
                        1 MINUTE FOR A 24 HR TEST.

                        NOTE THAT THE TIME CAN BE READ AT ANY POINT WITHIN
                        THE TEST WITHOUT AFFECTING THE TEST.


            9.3.2   DUAL CLOCK REAL TIME CLOCK TEST

                    THE USE OF A TEMPORARY CLOCK (REFERED AS COW) REDUCES THE TIME
                    REQUIRED FOR THE REAL TIME TEST.  THE SECOND CLOCK INTERRUPTS
                    THE FIRST CLOCK EVERY FIVE SECONDS.  THE DURATION OF THE COMBINED
                    REAL TIMES TESTS, WHEN THE DUAL CLOCK TEST IS USED IS
                    1 MIN : 50 SEC/FREQ VERSUS 17 MIN/FREQ FOR THE
                    SINGLE CLOCK REAL TIME TEST ALONE.

                    THE DUAL CLOCK TEST REQUIRES THAT THE CLOCK BE STARTED AS IN
                    THE SINGLE MODE.  RAISING SWITCH#2 CAUSES THE PRINTOUT
                    TO OCCUR AUTOMATICALLY.

                    THF COW MODULE SHOULD ONLY BE INSTALLED IN THE SYSTEM WHILE
                    THIS DIAGNOSTIC IS BEING USED.


                    TO CONVERT A STANDARD P CLOCK TO A "COW" MODULE:

                    1.      REMOVE JUMPER A4
                            CSR=772560
                            CSB=772562
                            CTR=772564

                    2.      ADD JUMPER V8
                            VECTOR LOCATION IS 504
                            PSW       "     " 506
```

```
                        NOTE:   THIS VECTOR IS IN FLOATING VECTOR SPACE,CAUTION IS ADVICED
                                WITH RESPECT TO ALLOWING VECTOR CONFLICTS.


                        9.3.2.1 PROCEDURE FOR DUAL CLOCK REAL TIME CLOCK TEST

                                1.  LOAD ADDRESS 214, DEPRESS START (100KHZ TEST)

                                2.  ENTER THE TIME VIA THE TTY KEYBOARD AS DESCRIBED PREVIOUSLY

                                3.  SET THE SWITCHES IN THE SWITCH REGISTER TO 000004,
                                    THE TTY WILL PRINT THE TIME AT 5 SECOND INTERVALS

                                4.  CONSECUTIVE PRINTOUTS WILL BE WITHIN 5.00 PLUS OR
                                    MINUS .01 SECONDS OF EACH OTHER.  ALLOW THE TEST TO
                                    RUN FOR AT LEAST TEN PRINTOUTS.  IF THE TOLERANCE IS
                                    EXCEEDED, THE CLOCK IS DEFECTIVE.

                                5.  LOAD ADDRESS 220, DEPRESS START (10KHZ TEST)

                                6.  REPEAT STEPS 2-4

                                7.  LOAD ADDRESS 224, IF 60HZ, OR 230 IF 50HZ DEPRESS START (LINE TEST)

                                8.  REPEAT STEPS 2 & 3

                                9.  CONSECUTIVE PRINTOUTS WILL BE WITHIN 5.00 PLUS OR
                                    MINUS .04 SECONDS OF EACH OTHER.  TYPICALLY, AND
                                    5.00 PLUS OR MINUS .2 SECONDS WORST CASE, DUE
                                    TO POSSIBLE AC LINE FREQUENCY VARIATIONS.  ALLOW THE
                                    TEST TO RUN FOR AT LEAST TEN PRINTOUTS.  IF THE TOLERANCE
                                    IS EXCEEDED, THE CLOCK IS DEFECTIVE.

                        10.             THIS KW11-P DIAGNOSTIC WILL GO OUT & FIND IF THIS SHOULD
                        RUN WITH CPU THAT HAS A SWITCH REG. OR WILL RUN WITH A PDP-11/04
                        THAT HAS NO SWITCH REGISTER.  IF CPU HAS NO SWITCH REG.
                        LOCATION 176 EQUALS SOFTWARE SWITCH REGISTER. IN THE ABOVE TEST
                        TYPING  G(CONTROL-G) WILL ALLOW YOU TO ENTER/ALTER THE SOFTWARE SWITCH SETTINGS
                           .ENDR
```

```
                                .TITLE  CZKWBJO KW11-P RT CLK TST

                                .SBTTL          BASIC TEST
                                ;COPYRIGHT 1971, 1978 DIGITAL EQUIPMENT CORP., MAYNARD, MASS. 01754
                                ;JOHN RODENHISER/JIM LACEY
                                        .ENABL AMA,ABS
          000000                        .=0
                                ;TRAP CATCHER 0-200
          000030                        .=30
 000030   005650                        PRINT
 000032   000340                        340
 000034   006150                        SCOPEC
 000036   000340                        340
          000046                        .=46
 000046   005174                        LOGICAL
          104000                        HLT=EMT
          177776                        CC=177776
          000240                        NOP=240
          104400                        SCOPE=TRAP
          000176                        SOFTSR=176              ;SOFTWARE SWITCH REGISTER
          000776                        BUFF=776
          000200                        .=200
 000200   000137  001046               JMP     @#BEGIN2        ;START BASIC TEST
 000204   000137  001150               JMP     @#BEGIN         ;RESTART BASIC TEST
 000210   000137  005210               JMP     @#BEGIN1        ;START TIMING TEST
 000214   000137  006714               JMP     @#K100HZ        ;DOUBLE OR SINGAL CLK TEST. 100KHZ.
 000220   000137  007000               JMP     @#K10HZ         ;DOUBLE OR SINGLE CLK TEST. 10KHZ.
 000224   000137  007064               JMP     @#H60Z          ;DOUBLE OR SINGLE CLK TEST. 60HZ.
 000230   000137  007150               JMP     @#H50Z          ;DOUBLE OR SINGLE CLK TEST. 50HZ

          001000                        .=1000
 001000   172540               CSR:    172540                          ;CONTROL AND STATUS REGISTER
 001002   172542               CSB:    172542                          ;COUNT SET BUFFER
 001004   172544               CTR:    172544                          ;COUNTER
 001006   000104               CKV:    104                             ;CLOCK VECTOR ADDRESS
 001010   000106               CKVS:   106
 001012   177566               TDBR:   177566
 001014   177564               TCSR:   177564
 001016   000000               TEMP1:  0
 001020   000000               TEMP:   0
 001022   000001               ICOUNT: 1
 001024   177740               DEL1:   -40
 001026   177730               DEL2:   -50
 001030   160000               DEL3:   -20000
 001032   160000               DEL4:   -20000
 001034   177700               ADJ:    -100                    ;DELAY ADJUSTMENT FOR 11/70
                                                                 ; & 11/45 WITH MOS MEM.
 001036   177660                       -120                     ;
 001040   140000                       -40000                   ;
 001042   140000                       -40000                   ;
 001044   177570               SR:     177570


 001046   012706  000776       BEGIN2: MOV     #BUFF,%6
```

```
001052  023737  000042  000046          CMP     @#42,   @#46    ;UNDER ACT ?
001060  001404                          BEQ     1$              ;YES-SKIP TITLE PRINT OUT
001062  012702  006436                  MOV     #MSG3,  %2
001066  004737  006266                  JSR     %7,     TOP     ;PRINT TITLE
001072  004737  011652          1$:     JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
001076  004737  011610                  JSR     %7,DELADJ       ;IS ADJUSTMENT IN DELAY REQUIRED
001102  013746  000004                  MOV     @#4,-(%6)
001106  012737  001230  000004          MOV     #XOR,@#4
001114  005737  177060                  TST     @#177060
001120  012637  000004                  MOV     (%6)+,@#4
001124  012737  177777  006252          MOV     #-1,@#XORFLG
001132  012737  000001  001022          MOV     #1,@#ICOUNT
001140  012702  006540                  MOV     #XORM,%2
001144  004737  006266                  JSR     %7,TOP

001150  012706  000776          BEGIN:  MOV     #BUFF,%6                ;SET UP STACK FOR SCOPE LOOPS
001154  004737  011652                  JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
001160  004737  011610                  JSR     %7,DELADJ       ;IS ADJUSTMENT IN DELAY REQUIRED
001164  012737  005572  000024          MOV     #PWRF1,24               ;INIT POWER FAIL POINTER
001172  005077  005442                  CLR     @PSW                    ;CLEAR PROC. STATUS REG.
001176  005037  001020                  CLR     TEMP
001202  005037  006250                  CLR     SCOPEF                  ;INIT. SCOPEF TAG
001206  005037  001016                  CLR     TEMP1
001212  012737  001254  006264          MOV     #T0,RETURN              ;SET UP RESTART OF PROGRAM
001220  005037  005764                  CLR     PRINT1                  ;INITIALIZE ERROR PRINTOUT READING
001224  000137  001254                  JMP     T0

001230  022626                  XOR:    CMP     (%6)+,(%6)+
001232  012637  000004                  MOV     (%6)+,@#4
001236  012737  000005  001022          MOV     #5,@#ICOUNT
001244  005037  006252                  CLR     @#XORFLG
001250  000137  001150                  JMP     @#BEGIN
                                ;TEST INIT TO CLEAR CONTROL AND STATUS REGISTER

001254  013746  000004          T0:     MOV     @#4,-(%6)
001260  012737  001312  000004          MOV     #CSRT,@#4
001266  012777  100377  177504          MOV     #100377,@CSR
001274  000005                          RESET
001276  032777  100377  177474          BIT     #100377,@CSR
001304  001413                          BEQ     T1
001306  104000                          HLT                             ;ERROR, INIT FAILED TO CLEAR ALL BITS OF CSR.
001310  000411                          BR      T1
001312  022626                  CSRT:   CMP     (%6)+,(%6)+
001314  012637  000004                  MOV     (%6)+,@#4
001320  032777  040000  177516          BIT     #40000,@SR
001326  001352                          BNE     T0
001330  000000                          HALT                    ;NO SSYN FROM DEVICE
001332  000750                          BR      T0
                                ;TEST COUNT SET BUFFER
001334  012637  000004          T1:     MOV     (%6)+,@#4
001340  104400                          SCOPE
001342  012777  177777  177432          MOV     #-1,@CSB
001350  005777  177426                  TST     @CSB
001354  001401                          BEQ     .+4
001356  104000                          HLT                             ;ERR, FAILED TO GIVE ZERO'S FROM WRITE ONLY REG.
001360  012737  177777  001020          MOV     #-1,@#TEMP
```

```
  541  001366  012777  000000  177410          MOV     #0,@CTR
  542  001374  023777  001020  177402          CMP     @#TEMP,@CTR
  543  001402  001401                          BEQ     .+4
  544  001404  104000                          HLT                             ;CTR CHANGED WHEN WRITTEN TO
  545                                  ;TEST COUNT SET BUFFER TO ACCEPT A COUNT PATTERN
  546                                  ;TEST COUNTER TO CONTAIN COUNT SET BUFFER VALUE
  547  001406  005037  001020                  CLR     TEMP
  548  001412  104400                          SCOPE
  549  001414  013777  001020  177360  T3:     MOV     TEMP,@CSB
  550  001422  023777  001020  177354          CMP     TEMP,@CTR
  551  001430  001401                          BEQ     .+4
  552  001432  104000                          HLT                                     ;ERROR, CTR NOT=TEMP
  553  001434  005237  001020                  INC     TEMP                            ;+1 TO COUNT PATTERN
  554  001440  001365                          BNE     T3                              ;REPEAT UNTIL COUNT OVERFLOWS
  555                                  ;TEST THAT CTR REMAINS CONSTANT IF RUN CLEAR
  556  001442  104400                  T3A:    SCOPE
  557  001444  005077  177330                  CLR     @CSR
  558  001450  012777  177777  177324          MOV     #-1,@CSB
  559  001456  013737  001030  001020          MOV     @#DEL3,@#TEMP
  560  001464  005237  001020          1$:     INC     @#TEMP
  561  001470  001375                          BNE     1$
  562  001472  022777  177777  177304          CMP     #-1,@CTR
  563  001500  001401                          BEQ     .+4
  564  001502  104000                          HLT                             ;CTR CHANGED ALTHOUGH RUN 0
  565                                  ;TEST THAT CTR REMAINS CONSTANT WHEN CSR IS REF'D
  566  001504  104400                  T3B:    SCOPE
  567  001506  005077  177266                  CLR     @CSR
  568  001512  012777  177777  177262          MOV     #-1,@CSB
  569  001520  013737  001030  001020          MOV     @#DEL3,@#TEMP
  570
  571  001526  012777  177736  177244  1$:     MOV     #177736,@CSR
  572  001534  017700  177240                  MOV     @CSR,%0
  573  001540  012777  000000  177232          MOV     #0,@CSR
  574  001546  017700  177226                  MOV     @CSR,%0
  575  001552  005237  001020                  INC     @#TEMP
  576  001556  001363                          BNE     1$
  577  001560  022777  177777  177216          CMP     #-1,@CTR
  578  001566  001401                          BEQ     .+4
  579  001570  104000                          HLT                             ;CTR CHANGED BY CSR REF
  580                                  ;TEST INIT TO CLEAR COUNT SET BUFFER WHEN IT IS =-1
  581  001572  104400                  T4:     SCOPE
  582  001574  012777  177777  177200          MOV     #-1,@CSB
  583  001602  000005                          RESET
  584  001604  005777  177174                  TST     @CTR
  585  001610  001401                          BEQ     .+4
  586  001612  104000                          HLT                                     ;ERROR, INIT FAILED TO CLEAR CSB
  587                                  ;TEST RATE SELECT (BIT,2) MAY BE SET AND CLEARED
  588  001614  104400                  T5:     SCOPE
  589  001616  012777  000002  177154          MOV     #2,@CSR
  590  001624  022777  000002  177146          CMP     #2,@CSR
  591  001632  001401                          BEQ     .+4
  592  001634  104000                          HLT                                     ;ERROR, CSR NOT = 2
  593  001636  012777  000004  177134          MOV     #4,@CSR
  594  001644  022777  000004  177126          CMP     #4,@CSR
  595  001652  001401                          BEQ     .+4
  596  001654  104000                          HLT                                     ;ERROR, CSR NOT = 4
```

```
  597  001656  012777  000006  177114          MOV     #6,@CSR
  598  001664  022777  000006  177106          CMP     #6,@CSR
  599  001672  001401                          BEQ     .+4
  600  001674  104000                          HLT                             ;ERROR, CSR NOT = 6
  601  001676  005077  177076                  CLR     @CSR
  602  001702  005777  177072                  TST     @CSR
  603  001706  001401                          BEQ     .+4
  604  001710  104000                          HLT                             ;ERROR, CSR NOT = 0
  605                                  ;TEST MODE (BIT 3) CAN BE SET AND CLEARED
  606  001712  104400                  T6:     SCOPE
  607  001714  012777  000010  177056          MOV     #10,@CSR
  608  001722  022777  000010  177050          CMP     #10,@CSR
  609  001730  001401                          BEQ     .+4
  610  001732  104000                          HLT                             ;ERROR, CSR NOT = 10
  611  001734  005077  177040                  CLR     @CSR
  612  001740  005777  177034                  TST     @CSR
  613  001744  001401                          BEQ     .+4
  614  001746  104000                          HLT                             ;ERROR, CSR NOT = 0
  615                                  ;TEST UP/DN (BIT 4) CAN BE SET AND CLEARED
  616  001750  104400                  T7:     SCOPE
  617  001752  012777  000020  177020          MOV     #20,@CSR
  618  001760  022777  000020  177012          CMP     #20,@CSR
  619  001766  001401                          BEQ     .+4
  620  001770  104000                          HLT                             ;ERROR, CSR NOT = 20
  621  001772  005077  177002                  CLR     @CSR
  622  001776  005777  176776                  TST     @CSR
  623  002002  001401                          BEQ     .+4
  624  002004  104000                          HLT                             ;ERROR, CSR NOT = 0
  625
  626
  627                                  ;TEST INTERRUPT ENABLE (BIT 6) CAN BE SET AND CLEARED
  628  002006  104400                  T9:     SCOPE
  629  002010  012737  000340  177776          MOV     #340,CC                 ;SET PROCESSOR PRIORITY LEVEL 7
  630  002016  012777  000100  176754          MOV     #100,@CSR
  631  002024  022777  000100  176746          CMP     #100,@CSR
  632  002032  001401                          BEQ     .+4
  633  002034  104000                          HLT                             ;ERROR, CSR NOT = 100
  634  002036  005077  176736                  CLR     @CSR
  635  002042  005777  176732                  TST     @CSR
  636  002046  001401                          BEQ     .+4
  637  002050  104000                          HLT                             ;ERROR, CSR NOT = 0
  638                                  ;TEST RUN (BIT 0) CAN BE SET AND CLEARED
  639
  640  002052  104400                  T9A:    SCOPE
  641  002054  005077  176720                  CLR     @CSR
  642  002060  005037  001020                  CLR     TEMP
  643  002064  013777  001020  176710          MOV     TEMP,@CSB               ;START AT ZERO
  644  002072  012777  000021  176700          MOV     #21,@CSR                ;DISABLE INTERRUPT, COUNT UP, SET RUN
  645  002100  032777  000001  176672          BIT     #1,@CSR                 ;CHECK IF ZERO IS STILL SET
  646  002106  001001                          BNE     .+4
  647  002110  104000                          HLT                             ;CSR LOST BIT 0 AFTER BIT INSTRUCTION
  648  002112  104400                          SCOPE
  649  002114  005077  176660                  CLR     @CSR
  650  002120  005037  001020                  CLR     TEMP
  651  002124  013777  001020  176650          MOV     TEMP,@CSB               ;START AT ZERO
  652  002132  012777  000020  176640          MOV     #20,@CSR                ;DISABLE INTERRUPT, COUNT UP, DO NOT SET RUN
```

```
  653  002140  052777  000001  176632          BIS     #1,@CSR                 ;SET RUN
  654  002146  032777  000001  176624          BIT     #1,@CSR                 ;CHECK IF BIT 0 IS SET
  655  002154  001001                          BNE     .+4
  656  002156  104000                          HLT                             ;CSR LOST BIT 0 AFTER A BIS INSTRUCTION
  657  002160  104400                          SCOPE
  658  002162  005077  176612                  CLR     @CSR
  659  002166  005037  001020                  CLR     TEMP
  660  002172  013777  001020  176602          MOV     TEMP,@CSB               ;START AT ZERO
  661  002200  012777  000021  176572          MOV     #21,@CSR                ;DISABLE INTERRUPT, COUNT UP, SET RUN
  662  002206  012777  000020  176564          MOV     #20,@CSR                ;LEAVE ALL SAME RESET RUN
  663  002214  032777  000001  176556          BIT     #1,@CSR                 ;CHECK BIT 0
  664  002222  001401                          BEQ     .+4                     ;BRANCH IF NOT SET
  665  002224  104000                          HLT                             ;CSR PICKED BIT 0 ON A MOV.
  666
  667
  668                                  ; TEST FIX (BIT 5) TO SINGLE CLOCK COUNTER
  669                                  ; SET UP/DN (BIT 4) =0 TO ENABLE COUNT DOWN
  670  002226  104400                  T10:    SCOPE
  671  002230  005077  176544                  CLR     @CSR
  672  002234  012777  177777  176540          MOV     #-1,@CSB
  673  002242  012737  177776  001020          MOV     #-2,TEMP
  674  002250  012777  000040  176522  T10A:   MOV     #40,@CSR
  675  002256  023777  001020  176520          CMP     TEMP,@CTR
  676  002264  001401                          BEQ     .+4
  677  002266  104000                          HLT                             ;ERROR, COUNTER NOT = TEMP, DIDN'T COUNT DOWN
  678  002270  005337  001020                  DEC     TEMP                    ;-1 TO PATTERN COUNT
  679  002274  023727  001020  000000          CMP     TEMP,#0                 ;DONE ALL COUNTS?
  680  002302  001362                          BNE     T10A                    ;NO
  681                                  ;TEST FIX (BIT 5) TO SINGLE CLOCK COUNTER
  682                                  ;SET UP/DN (BIT 4)=1 TO ENABLE COUNT UP
  683  002304  104400                  T11:    SCOPE
  684  002306  005077  176466                  CLR     @CSR
  685  002312  005077  176464                  CLR     @CSB
  686  002316  012737  000001  001020          MOV     #1,TEMP
  687  002324  012777  000060  176446  T11A:   MOV     #60,@CSR
  688  002332  023777  001020  176444          CMP     TEMP,@CTR
  689  002340  001401                          BEQ     .+4
  690  002342  104000                          HLT                             ;ERROR, COUNTER NOT = TEMP, FAILED TO COUNT UP.
  691  002344  005237  001020                  INC     TEMP                    ;+1 TO PATTERN COUNT
  692  002350  023727  001020  000000          CMP     TEMP,#0         ;DONE ALL COUNTS ?
  693  002356  001362                          BNE     T11A                    ;NO
  694                                  ;TEST CLOCK TO COUNT DOWN AT ALL FREQUENCIES
  695                                  ;100KHZ
  696  002360  104400                  T12:    SCOPE
  697  002362  005077  176412                  CLR     @CSR
  698  002366  012777  000002  176406          MOV     #2,@CSB         ;COUNT SET BUFFER TO 2
  699  002374  012777  000001  176376          MOV     #1,@CSR                 ;DOWN COUNT , 100KHZ, GO
  700  002402  013737  001024  001020          MOV     @#DEL1,@#TEMP
  701  002410  105777  176364          T12A:   TSTB    @CSR
  702  002414  100410                          BMI     T12B
  703  002416  062737  000001  001020          ADD     #1,@#TEMP
  704  002424  001371                          BNE     T12A
  705  002426  042777  000001  176344          BIC     #1,@CSR
  706  002434  104000                          HLT                             ;ERROR, P INTR (BIT 7) NOT = 1.
  707  002436  005777  176342          T12B:   TST     @CTR
  708  002442  001401                          BEQ     .+4
```

```
  709  002444  104000                        HLT                             ;ERROR, COUNTER DID NOT COUNT DOWN TO 0
  710
  711                                ;10KHZ
  712  002446  104400                T13:    SCOPE
  713  002450  005077  176324               CLR     @CSR
  714  002454  012777  000002  176320       MOV     #2,@CSB
  715  002462  012777  000003  176310       MOV     #3,@CSR                 ;DOWN COUNT, 10KHZ, GO
  716  002470  013737  001026  001020       MOV     @#DEL2,@#TEMP
  717  002476  105777  176276        T13A:  TSTB    @CSR
  718  002502  100410                       BMI     T13B
  719  002504  062737  000001  001020       ADD     #1,@#TEMP
  720  002512  001371                       BNE     T13A
  721  002514  042777  000001  176256       BIC     #1,@CSR
  722  002522  104000                       HLT                             ;ERROR, P INTR (BIT 7) NOT = 1.
  723  002524  005777  176254        T13B:  TST     @CTR
  724  002530  001401                       BEQ     .+4
  725  002532  104000                       HLT                             ;ERROR, COUNTER DID NOT COUNTDOWN TO 0
  726                                ;LINE FREQ.
  727  002534  104400                T14:    SCOPE
  728  002536  005737  006252               TST     @#XORFLG
  729  002542  100432                       BMI     T15
  730  002544  005077  176230               CLR     @CSR
  731  002550  012777  000002  176224       MOV     #2,@CSB
  732  002556  012777  000005  176214       MOV     #5,@CSR                 ;DOWN COUNT, LINE FREQ., GO
  733  002564  013737  001030  001020       MOV     @#DEL3,@#TEMP
  734  002572  105777  176202        T14A:  TSTB    @CSR
  735  002576  100410                       BMI     T14B
  736  002600  062737  000001  001020       ADD     #1,@#TEMP
  737  002606  001371                       BNE     T14A
  738  002610  042777  000001  176162       BIC     #1,@CSR
  739  002616  104000                       HLT                             ;ERROR, P INTR (BIT 7) NOT=1
  740  002620  005777  176160        T14B:  TST     @CTR
  741  002624  001401                       BEQ     .+4
  742  002626  104000                       HLT                             ;ERROR, COUNTER DID NOT COUNT DOWN TO 0
  743                                ;EXT FREQ
  744  002630  104400                T15:    SCOPE
  745  002632  032777  000001  176204       BIT     #1,@SR                  ;
  746  002640  001432                       BEQ     T16                     ;
  747  002642  005077  176132               CLR     @CSR
  748  002646  012777  000002  176126       MOV     #2,@CSB
  749  002654  012777  000007  176116       MOV     #7,@CSR                 ;DOWN COUNT, EXT., GO
  750  002662  013737  001032  001020       MOV     @#DEL4,@#TEMP
  751  002670  105777  176104        T15A:  TSTB    @CSR
  752  002674  100410                       BMI     T15B
  753  002676  062737  000001  001020       ADD     #1,@#TEMP
  754  002704  001371                       BNE     T15A
  755  002706  042777  000001  176064       BIC     #1,@CSR
  756  002714  104000                       HLT                             ;ERROR, P INTR (BIT 7) NOT=1
  757  002716  005777  176062        T15B:  TST     @CTR
  758  002722  001401                       BEQ     .+4
  759  002724  104000                       HLT                             ;ERROR, COUNTER DID NOT COUNT DOWN TO 0
  760
  761                                ;TEST CLOCK TO COUNT UP AT ALL FREQUENCIES
  762                                ;100 KHZ
  763  002726  104400                T16:    SCOPE
  764  002730  005077  176044               CLR     @CSR
```

```
  765  002734  012777  177776  176040          MOV     #-2,@CSB
  766  002742  012777  000021  176030          MOV     #21,@CSR                ;UP COUNT, 100 KHZ, GO
  767  002750  013737  001024  001020          MOV     @#DEL1,@#TEMP
  768  002756  105777  176016          T16A:   TSTB    @CSR
  769  002762  100410                          BMI     T16B
  770  002764  062757  000001  001020          ADD     #1,@#TEMP
  771  002772  001371                          BNE     T16A
  772  002774  042777  000001  175776          BIC     #1,@CSR
  773  003002  104000                          HLT                             ;ERROR
  774  003004  005777  175774          T16B:   TST     @CTR
  775  003010  001401                          BEQ     .+4
  776  003012  104000                          HLT                             ;ERROR
  777                                  ;10 KHZ
  778  003014  104400                  T17:    SCOPE
  779  003016  005077  175756                  CLR     @CSR
  780  003022  012777  177776  175752          MOV     #-2,@CSB
  781  003030  012777  000023  175742          MOV     #23,@CSR                ;UP COUNT, 10 KHZ, GO
  782  003036  013737  001026  001020          MOV     @#DEL2,@#TEMP
  783  003044  105777  175730          T17A:   TSTB    @CSR
  784  003050  100410                          BMI     T17B
  785  003052  062737  000001  001020          ADD     #1,@#TEMP
  786  003060  001371                          BNE     T17A
  787  003062  042777  000001  175710          BIC     #1,@CSR
  788  003070  104000                          HLT                             ;ERROR
  789  003072  005777  175706          T17B:   TST     @CTR
  790  003076  001401                          BEQ     .+4
  791  003100  104000                          HLT                             ;ERROR
  792                                  ;LINE FREQ.
  793  003102  104400                  T18:    SCOPE
  794  003104  005737  006252                  TST     @#XORFLG
  795  003110  100432                          BMI     T19
  796  003112  005077  175662                  CLR     @CSR
  797  003116  012777  177776  175656          MOV     #-2,@CSB
  798  003124  012777  000025  175646          MOV     #25,@CSR                ;UP COUNT, LINE, GO
  799  003132  013737  001030  001020          MOV     @#DEL3,@#TEMP
  800  003140  105777  175634          T18A:   TSTB    @CSR
  801  003144  100410                          BMI     T18B
  802  003146  062737  000001  001020          ADD     #1,@#TEMP
  803  003154  001371                          BNE     T18A
  804  003156  042777  000001  175614          BIC     #1,@CSR
  805  003164  104000                          HLT                             ;ERROR
  806  003166  005777  175612          T18B:   TST     @CTR
  807  003172  001401                          BEQ     .+4
  808  003174  104000                          HLT                             ;ERROR
  809
  810                                  ;EXT FREQ.
  811  003176  104400                  T19:    SCOPE
  812  003200  032777  000001  175636          BIT     #1,@SR                  ;
  813  003206  001433                          BEQ     T20                     ;
  814  003210  005077  175564                  CLR     @CSR
  815  003214  012777  177776  175560          MOV     #-2,@CSB
  816  003222  012777  000027  175550          MOV     #27,@CSR                ;UP COUNT, EXT FREQ, GO
  817  003230  013737  001032  001020          MOV     @#DEL4,@#TEMP
  818  003236  105777  175536          T19A:   TSTB    @CSR
  819  003242  100411                          BMI     T19B
  820  003244  062737  000001  001020          ADD     #1,@#TEMP
```

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  821  003252  001371                          BNE     T19A
  822  003254  042777  000001  175516          BIC     #1,@CSR
  823  003262  104000                          HLT                             ;ERROR,
  824  003264  000005                          RESET
  825  003266  005777  175512          T19B:   TST     @CTR
  826  003272  001401                          BEQ     .+4
  827  003274  104000                          HLT                             ;ERROR,
  828                                  ;TEST THAT INTERRUPT OCCURS TO PROPER VECTOR WITH PROCESSOR PRIORITY 4
  829  003276  104400                  T20:    SCOPE
  830  003300  012737  000200  177776          MOV     #200,CC                 ;SET PROCESSOR PRIORITY 4
  831  003306  005077  175476                  CLR     @CKVS                   ;CLEAR INTERRUPT RETURN STATUS
  832  003312  005077  175462                  CLR     @CSR
  833  003316  012777  000002  175456          MOV     #2,@CSB
  834  003324  012777  003366  175454          MOV     #T20A,@CKV              ;SET UP INTERRUPT RETURN VECTOR
  835  003332  012777  000101  175440          MOV     #101,@CSR               ;ENABLE INTERRUPT
  836  003340  013737  001024  001020          MOV     @#DEL1,@#TEMP
  837  003346  005237  001020          1$:     INC     @#TEMP
  838  003352  001375                          BNE     1$
  839  003354  042777  000001  175416          BIC     #1,@CSR
  840  003362  104000                          HLT                             ;ERROR, INTERRUP, FAILED TO OCCUR.
  841  003364  000420                          BR      T21
  842  003366  017737  175406  001020  T20A:   MOV     @CSR,@#TEMP
  843  003374  105737  001020                  TSTB    @#TEMP
  844  003400  100401                          BMI     .+4
  845  003402  104000                          HLT                             ;DONE NOT SET ON INT.
  846  003404  032737  000001  001020          BIT     #1,@#TEMP
  847  003412  001401                          BEQ     .+4
  848  003414  104000                          HLT                             ;RUN NOT CLEARED
  849  003416  005077  175356                  CLR     @CSR
  850  003422  012706  000776                  MOV     #BUFF,%6
  851                                  ;TEST THAT INTERRUPT OCCURS WITH PROCESSOR PRIORITY 5
  852  003426  104400                  T21:    SCOPE
  853  003430  012737  000240  177776          MOV     #240,CC                 ;SET PROCESSOR PRIORITY 5
  854  003436  012777  003512  175342          MOV     #T21A,@CKV              ;SET UP INTERRUPT RETURN STATUS
  855  003444  005077  175330                  CLR     @CSR
  856  003450  012777  000002  175324          MOV     #2,@CSB
  857  003456  012777  000101  175314          MOV     #101,@CSR               ;ENABLE INTERRUPT
  858  003464  013737  001024  001020          MOV     @#DEL1,@#TEMP
  859  003472  005237  001020          1$:     INC     @#TEMP
  860  003476  001375                          BNE     1$
  861  003500  042777  000001  175272          BIC     #1,@CSR
  862  003506  104000                          HLT                             ;ERROR, INTERRUPT FAILED TO OCCUR
  863  003510  000404                          BR      T22
  864  003512  005077  175262          T21A:   CLR     @CSR                    ;RETURN HERE AFTER INTERRUPT
  865  003516  012706  000776                  MOV     #BUFF,%6
  866                                  ;TEST THAT INTERRUPT IS INHIBITED WITH PROCESSOR PRIORITY 6
  867  003522  104400                  T22:    SCOPE
  868  003524  012737  000300  177776          MOV     #300,CC                 ;SET PROCESSOR PRIORITY 6
  869  003532  012777  003602  175246          MOV     #T22A,@CKV              ;SET UP INTERRUPT RETURN
  870  003540  005077  175234                  CLR     @CSR
  871  003544  012777  000002  175230          MOV     #2,@CSB
  872  003552  012777  000101  175220          MOV     #101,@CSR               ;INTERRUPT ENABLE
  873  003560  013737  001024  001020          MOV     @#DEL1,@#TEMP
  874  003566  005237  001020          1$:     INC     @#TEMP
  875  003572  001375                          BNE     1$
  876  003574  005077  175200                  CLR     @CSR
```

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  877  003600  000406                        BR      T23
  878  003602  042777  000001  175170  T22A: BIC     #1,@CSR
  879  003610  104000                        HLT                     ;ERROR, INT SHOULDN'T HAVE OCCURRED
  880  003612  012706  000776                MOV     #BUFF,%6
  881
  882                                  ;TEST SINGLE INTERRUPT (MODE 0) ON OVERFLOW
  883  003616  104400                  T23:  SCOPE
  884  003620  012737  000200  177776        MOV     #200,CC                 ;SET PROCESSOR PRIORITY 4
  885  003626  005077  175146                CLR     @CSR
  886  003632  012777  177776  175142        MOV     #-2,@CSB
  887  003640  012777  003702  175140        MOV     #T23A,@CKV              ;SET INTERRUPT RETURN
  888  003646  012777  000121  175124        MOV     #121,@CSR               ;INTERRUPT ENABLE, UP COUNT, 100 KHZ, GO
  889  003654  013737  001024  001020        MOV     @#DEL1,@#TEMP
  890  003662  062737  000001  001020  T23AA: ADD     #1,@#TEMP                       ;WASTE TIME
  891  003670  001374                        BNE     T23AA
  892  003672  042777  000001  175100        BIC     #1,@CSR
  893  003700  104000                        HLT                             ;ERROR, INTERRUPT FAILED TO OCCUR.
  894  003702  005077  175072          T23A: CLR     @CSR                    ;RETURN HERE AFTER INTERRUPT.
  895  003706  012706  000776                MOV     #BUFF,%6                ;RESET STACK
  896                                  ;TEST REPEATED INTERRUPT (MODE 1).
  897  003712  104400                  T24:  SCOPE
  898  003714  012737  177700  001016        MOV     #-100,TEMP1             ;SET UP COUNTER FOR INTER
  899  003722  012777  003774  175056        MOV     #T24B,@CKV              ;SET INTERRUPT RETURN
  900  003730  012777  000010  175044        MOV     #10,@CSB                ;SET UP COUNT SET BUFFER
  901  003736  012777  000111  175034        MOV     #111,@CSR               ;INTERRUPT ENABLE, REPEATED INTERRUPTS, 100 KHZ,
  902  003744  013737  001024  001020  T24A: MOV     @#DEL1,@#TEMP
  903  003752  062737  000001  001020        ADD     #1,@#TEMP
  904  003760  001374                        BNE     .-6
  905  003762  042777  000001  175010        BIC     #1,@CSR
  906  003770  104000                        HLT                             ;ERROR, INTERRUPT FAILED TO OCCUR
  907  003772  000406                        BR      T24C
  908  003774  022626                  T24B: CMP     (6)+,(6)+               ;POP STACK
  909  003776  005237  001016                INC     TEMP1                   ;DONE 100 INTERRUPTS?
  910  004002  001360                        BNE     T24A                    ;NO
  911  004004  005077  174770                CLR     @CSR                    ;CLEAR CLOCK
  912
  913
  914
  915
  916                                  ;SYNCHRONIZATION TEST
  917                                  ;NO. 1 FOR
  918                                  ;KW11-P BOARDS THAT
  919                                  ;ARE REV F OR GREATER
  920
  921
  922  004010  104400                  T24C: SCOPE
  923  004012  005003                        CLR     %3              ;
  924  004014  032777  000020  175022        BIT     #20,@SR
  925  004022  001002                        BNE     1$              ;
  926  004024  000137  004264                JMP     T25             ;
  927  004030  012777  010000  174744  1$:   MOV     #10000,@CSB     ;LOAD COUNTER
  928  004036  012777  000001  174734        MOV     #1,@CSR         ;GO COUNT DOWN, 100 KHZ
  929  004044  017700  174734                MOV     @CTR,%0         ;SAVE CTR
  930  004050  020027  010000                CMP     %0,#10000       ;DID COUNT INCREASE?
  931  004054  101404                        BLOS    2$              ;BRANCH IF OK TO 1$
  932  004056  010037  001020                MOV     %0,@#TEMP               ;
```

```
 933  004062  104000                        HLT                     ;SYNC ERROR
 934  004064  000404                        BR      T24D            ;END TEST
 935  004066  005077  174706        2$:     CLR     @CSR            ;CLR CSR
 936  004072  005203                        INC     %3              ;NO OF TIMES THROUGH PROGRAM DETECTS 2(16)
 937  004074  001355                        BNE     1$              ;2(16) YET, IF NOT GO BACK TO LOOP 1
 938
 939
 940
 941                                ;SYNCHRONIZATION TEST
 942                                ;NO. 2 FOR KW11-P
 943                                ;BOARDS THAT ARE
 944                                ;REV F OR GREATER
 945
 946
 947  004076  104400                T24D:   SCOPE
 948  004100  017746  174702                MOV     @CKV,-(%6)      ;SAVE CLOCK VECTOR
 949  004104  012777  000340  002526        MOV     #340,@PSW       ;PS=7 STOPS ALL INTRS
 950  004112  005037  004246                CLR     TIKTIK          ;CLEAR CLOCK COUNTER
 951  004116  005037  006632                CLR     CNT             ;CLEAR ITERATION COUNT
 952  004122  012777  004240  174656        MOV     #CLKSER,@CKV    ;SETUP INTR SERVICE RTN
 953  004130  012777  000300  174652        MOV     #300,@CKVS      ;SETUP INTR PSW
 954  004136  012777  000010  174636        MOV     #10,@CSB        ;KW11 COUNT = 10
 955  004144  012777  000111  174626        MOV     #111,@CSR       ;SET TO RUN @100KH
 956                                                                ;INTR ENABLE & COUNT DOWN
 957                                                                ;AND REPEAT INTR MODE
 958  004152                        LOOP:
 959  004152  012777  000340  002460        MOV     #340,@PSW       ;PS=7 STOPS ALL INTRS
 960  004160  004737  004250                JSR     PC,TYPE         ;100MS DELAY @PR7
 961  004164  005077  002450                CLR     @PSW            ;PS=0 ALLOWS INTRS
 962  004170  013701  004246                MOV     TIKTIK,R1       ;GET CURRENT CLK COUNT
 963  004174  004737  004250                JSR     PC,TYPE         ;100MS DELAY @PR0
 964  004200  023701  004246                CMP     TIKTIK,R1       ;ANY INTRS DURING DELAY?
 965  004204  001001                        BNE     1$              ;IF YES,GO TO 1$
 966  004206  104000                        HLT                     ;ELSE THERE WAS AN ERROR
 967                                                                ;CHECK FOR JUMPERS ON THE
 968                                                                ;KW11-P BOARD NEAR I.C.
 969                                                                ;LOCATIONS E41 & E51 ON REV F
 970                                                                ;BOARD & GREATER ONLY
 971  004210                        1$:
 972  004210  005237  006632                INC     CNT
 973  004214  022737  000170  006632        CMP     #120.,CNT       ;120 ITERATIONS?
 974  004222  001353                        BNE     LOOP            ;IF NOT,GO BACK TO LOOP
 975  004224  012677  174556                MOV     (%6)+,@CKV      ;ELSE RESTORE THE VECTOR
 976  004230  005077  174544                CLR     @CSR            ;CLEAR CONTROL REG
 977  004234  000137  004264                JMP     T25             ;AND GO TO NEXT TEST
 978
 979  004240                        CLKSER:
 980  004240  005237  004246                INC     TIKTIK          ;INC CLK COUNTER
 981  004244                        CLKXIT:
 982  004244  000002                        RTI                     ;ELSE EXIT RTN
 983
 984  004246  000000                TIKTIK: 0
 985
 986  004250  105777  174540        TYPE:   TSTB    @TCSR           ;READY TO SEND
 987  004254  100375                        BPL     TYPE            ;BR IF NOT
 988  004256  110077  174530                MOVB    R0,@TDBR        ;SEND THEM A MESSAGE
```

```
 989  004262  000207                          RTS     PC
 990
 991
 992
 993
 994
 995                                  ;TEST 100 KHZ REPEATABILITY
 996  004264  104400                  T25:    SCOPE
 997  004266  032777  000004  174550          BIT     #4,@SR          ;ARE TWO CLK'S PRESENT
 998  004274  001002                          BNE     3$              ;BRANCH IF SW#2 IS UP
 999  004276  000137  004740                  JMP     T27             ;EXIT IF ONLY ONE CLK
1000  004302  005077  174472          3$:     CLR     @CSR
1001  004306  012777  000000  174466          MOV     #0,@CSB         ;SET CTR
1002  004314  012777  000021  174456          MOV     #21,@CSR        ;COUNT UP 100KHZ GO
1003  004322  004537  004416                  JSR     R5,DELY         ;GO TO DELAY SUBROUTINE
1004  004326  105777  174446                  TSTB    @CSR            ;TEST DONE BIT SET
1005  004332  100001                          BPL     1$
1006  004334  104000                          HLT                     ;DONE BIT SET TOO SOON
1007  004336  017737  174442  001020  1$:     MOV     @CTR,@#TEMP     ;DONE NOT SET SO SAVE CTR
1008  004344  005077  174430                  CLR     @CSR
1009  004350  012777  000000  174424          MOV     #0,@CSB
1010  004356  012777  000021  174414          MOV     #21,@CSR
1011  004364  004537  004416                  JSR     R5,DELY
1012  004370  105777  174404                  TSTB    @CSR
1013  004374  100001                          BPL     2$
1014  004376  104000                          HLT
1015  004400  017737  174400  001016  2$:     MOV     @CTR,@#TEMP1    ;HERE WE ARE SAVING SEC CNT
1016  004406  004537  004446                  JSR     R5,CACL         ;GO DETERMINE ACCURACY OF CNT'S
1017  004412  104000                          HLT
1018  004414  000432                          BR      T25A
1019
1020  004416  005077  002154          DELY:   CLR     @CSR1           ;DELAY SUBROUTINE
1021  004422  012777  001130  002144          MOV     #1130,@CSB1
1022  004430  012777  000021  002140          MOV     #21,@CSR1
1023  004436  105777  002134          1$:     TSTB    @CSR1           ;WAIT 600 MIL.
1024  004442  100375                          BPL     1$
1025  004444  000205                          RTS     R5
1026
1027  004446  013700  001020          CACL:   MOV     @#TEMP,R0       ;COMPARE CTR1 WITH CTR2
1028  004452  013701  001016                  MOV     @#TEMP1,R1
1029  004456  160001                          SUB     R0,R1
1030  004460  100001                          BPL     1$
1031  004462  005401                          NEG     R1
1032  004464  022701  000005          1$:     CMP     #5,R1           ;DIFFERENCE MUST BE LESS THAN 5
1033  004470  002401                          BLT     2$
1034  004472  005725                          TST     (R5)+           ;UPDATE RETURN
1035  004474  010137  001020          2$:     MOV     R1,TEMP         ;DEFRENCE FOR PRINT OUT
1036  004500  000205                          RTS     R5
1037
1038                                  ;TEST 10 KHZ REPEATABILITY
1039                                  ;THIS TEST IS THE SAME AS T25 EXCEPT IT IS
1040                                  ;FOR 10KHZ.
1041  004502  104400                  T25A:   SCOPE
1042  004504  005077  174270                  CLR     @CSR
1043  004510  012777  000000  174264          MOV     #0,@CSB
1044  004516  012777  000023  174254          MOV     #23,@CSR
```

```
 1045  004524  004537  004416                    JSR     R5,DELY
 1046  004530  105777  174244                    TSTB    @CSR
 1047  004534  100001                            BPL     1$
 1048  004536  104000                            HLT
 1049  004540  017737  174240  001020  1$:       MOV     @CTR,@#TEMP
 1050  004546  005077  174226                    CLR     @CSR
 1051  004552  012777  000000  174222            MOV     #0,@CSB
 1052  004560  012777  000023  174212            MOV     #23,@CSR
 1053  004566  004537  004416                    JSR     R5,DELY
 1054  004572  105777  174202                    TSTB    @CSR
 1055  004576  100001                            BPL     2$
 1056  004600  104000                            HLT
 1057  004602  017737  174176  001016  2$:       MOV     @CTR,@#TEMP1
 1058  004610  004537  004446                    JSR     R5,CACL
 1059  004614  104000                            HLT
 1060
 1061                                    ;TEST LINE REPEATABILITY
 1062                                    ;THIS TEST IS THE SAME AS T25 EXCEPT IT IS
 1063                                    ;FOR LINE FREQ.
 1064  004616  104400                    T26:    SCOPE
 1065  004620  005737  006252                    TST     @#XORFLG
 1066  004624  100445                            BMI     T27
 1067  004626  005077  174146                    CLR     @CSR
 1068  004632  012777  000000  174142            MOV     #0,@CSB
 1069  004640  012777  000025  174132            MOV     #25,@CSR
 1070  004646  004537  004416                    JSR     R5,DELY
 1071  004652  105777  174122                    TSTB    @CSR
 1072  004656  100001                            BPL     1$
 1073  004660  104000                            HLT
 1074  004662  017737  174116  001020  1$:       MOV     @CTR,@#TEMP
 1075  004670  005077  174104                    CLR     @CSR
 1076  004674  012777  000000  174100            MOV     #0,@CSB
 1077  004702  012777  000025  174070            MOV     #25,@CSR
 1078  004710  004537  004416                    JSR     R5,DELY
 1079  004714  105777  174060                    TSTB    @CSR
 1080  004720  100001                            BPL     2$
 1081  004722  104000                            HLT
 1082  004724  017737  174054  001016  2$:       MOV     @CTR,@#TEMP1
 1083  004732  004537  004446                    JSR     R5,CACL
 1084  004736  104000                            HLT
 1085                                    ;TEST ERROR (BIT 15) TO SET WHEN INTERRUPT IS NOT SERVICED IN REPEAT MODE
 1086  004740  104400                    T27:    SCOPE
 1087  004742  005077  174032                    CLR     @CSR
 1088  004746  012737  000340  177776            MOV     #340,CC                 ;SET PROCESSOR PRIORITY 7
 1089  004754  012777  000002  174020            MOV     #2,@CSB                 ;SET COUNTER FOR FAST INTERRUPTS
 1090  004762  012777  000111  174010            MOV     #111,@CSR               ;INT EN, REPEATED INT, DOWN COUNT, 100 KHZ, GO
 1091  004770  013737  001024  001020            MOV     @#DEL1,@#TEMP
 1092  004776  062737  000001  001020            ADD     #1,@#TEMP
 1093  005004  001374                            BNE     .-6
 1094  005006  005777  173766                    TST     @CSR
 1095  005012  100404                            BMI     1$
 1096  005014  042777  000001  173756            BIC     #1,@CSR
 1097  005022  104000                            HLT                             ;ERROR, ERROR (BIT 15) NOT SET
 1098  005024  005077  173750          1$:       CLR     @CSR
 1099  005030  005777  173744                    TST     @CSR
 1100  005034  100001                            BPL     .+4
```

```
005036  104000                          HLT                             ;ERR, FAILED TO CLEAR WHEN REF.
                                ;TEST BIT 15 IS CLEARED BY INIT
005040  104400                  T27A:   SCOPE
005042  012737  000340  177776          MOV     #340,CC
005050  012777  000002  173724          MOV     #2,@CSB
005056  012777  000111  173714          MOV     #111,@CSR
005064  013737  001024  001020          MOV     @#DEL1,@#TEMP
005072  062737  000001  001020          ADD     #1,@#TEMP
005100  001374                          BNE     .-6
005102  005777  173672                  TST     @CSR
005106  100404                          BMI     1$
005110  042777  000001  173662          BIC     #1,@CSR
005116  104000                          HLT                             ;BIT 15 NOT SET
005120  000005                  1$:     RESET
005122  005777  173652                  TST     @CSR
005126  100001                          BPL     .+4
005130  104000                          HLT                             ;BIT 15 NOT CLEARED BY RESET
005132  104400                          SCOPE

                                ;BELL ON PASS COMPLETE
005134  012777  000207  173650  TSTEND: MOV     #207,@TDBR
005142  105777  173646                  TSTB    @TCSR
005146  100375                          BPL     .-4
005150  012777  000000  173634          MOV     #0,@TDBR                ;SEND A NULL CHAR.
005156  105777  173632                  TSTB    @TCSR
005162  100375                          BPL     .-4
005164  013702  000042                  MOV     @#42,%2
005170  001405                          BEQ     TRPA
005172  000005                          RESET
005174  004712                  LOGICAL:        JSR     %7,(2)
005176  000240                          NOP
005200  000240                          NOP
005202  000240                          NOP
005204  000137  001150          TRPA:   JMP     BEGIN
```

```
 1135
 1136                                   .SBTTL          TIMING TEST
 1137                                   ;RING TELETYPE BELL AT 10 SECOND INTERVALS USING REPEATED INTERRUPT MODE
 1138                                   ;1ST MINUTE = 100 KHZ
 1139                                   ;2ND MINUTE = 10 KHZ
 1140                                   ;3RD MINUTE = LINE
 1141                                   ;4TH MINUTE = EXTERNAL
 1142
 1143  005210  012706  000776          BEGIN1: MOV     #BUFF,%6
 1144  005214  004737  011652                  JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
 1145  005220  013777  001010  173560          MOV     CKVS,@CKV
 1146  005226  012777  000002  173554          MOV     #RTI,@CKVS
 1147  005234  012737  005602  000024          MOV     #PWRF2,24       ;INIT POWER FAIL POINTER
 1148  005242  000005                          RESET
 1149                                  ;100 KHZ
 1150  005244  012777  141520  173530          MOV     #50000.,@CSB    ;INIT COUNT SET BUFFER FOR .5 SECONDS
 1151  005252  012700  177772                  MOV     #-6,%0          ;COUNT 6(10 SECOND) INTERVALS
 1152  005256  012701  177754          T28:    MOV     #-20.,%1        ;COUNT 20(.5 SECOND) INTERVALS
 1153  005262  012777  000111  173510          MOV     #111,@CSR       ;100 KHZ, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
 1154  005270  000001                  T28A:   WAIT
 1155  005272  005201                          INC     %1              ;DONE 10 SECONDS?
 1156  005274  001375                          BNE     T28A            ;NO
 1157  005276  105777  173512                  TSTB    @TCSR
 1158  005302  100375                          BPL     .-4
 1159  005304  012777  000207  173500          MOV     #207,@TDBR
 1160  005312  005200                          INC     %0              ;DONE 6 TIMES?
 1161  005314  001360                          BNE     T28             ;NO
 1162  005316  042777  000101  173454          BIC     #101,@CSR       ;YES DISABLE INTERRUPTS
 1163                                  ;10 KHZ
 1164  005324  012777  011610  173450          MOV     #5000.,@CSB     ;INIT COUNT SET BUFFER FOR .5 SECONDS
 1165  005332  012700  177772                  MOV     #-6,%0          ;COUNT 6(10SECOND) INTERVALS
 1166  005336  012701  177754          T29:     MOV     #-20.,%1       ;COUNT 20(.5 SECOND) INTERVALS
 1167  005342  012777  000113  173430          MOV     #113,@CSR       ;10 KHZ, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
 1168  005350  000001                  T29A:   WAIT
 1169  005352  005201                          INC     %1              ;DONE 10 SECONDS?
 1170  005354  001375                          BNE     T29A            ;NO
 1171  005356  105777  173432                  TSTB    @TCSR           ;YES, RING BELL
 1172  005362  100375                          BPL     .-4
 1173  005364  012777  000207  173420          MOV     #207,@TDBR
 1174  005372  005200                          INC     %0              ;DONE 6 TIMES?
 1175  005374  001360                          BNE     T29             ;NO
 1176  005376  042777  000101  173374          BIC     #101,@CSR       ;YES, DISABLE INTERRUPTS
 1177                                  ;SET UP FOR 10 SECONDS AT LINE FREQ.
 1178  005404  005737  006252                  TST     @#XORFLG
 1179  005410  100677                          BMI     BEGIN1
 1180  005412  012737  001130  005570          MOV     #600.,LINE
 1181  005420  032777  000002  173416          BIT     #2,@SR
 1182  005426  001403                          BEQ     .+10
 1183  005430  012737  000764  005570          MOV     #500.,LINE
 1184                                  ;LINE
 1185  005436  013777  005570  173336          MOV     LINE,@CSB       ;INITIALZE COUNT SET BUFFER FOR 10 SECONDS
 1186  005444  012700  177772                  MOV     #-6,%0          ;COUNT 6 (10 SECOND) INTERVALS
 1187  005450  012777  000115  173322          MOV     #115,@CSR       ;LINE, REPEATED INTERRUPTS, INTERRUPT ENABLE, GO
 1188  005456  000001                  T30:    WAIT
 1189  005460  105777  173330                  TSTB    @TCSR
 1190  005464  100375                          BPL     .-4
```

```
 1191  005466  012777  000207  173316          MOV     #207,@TDBR      ;RING BELL
 1192  005474  005200                          INC     %0              ;DONE 6 TIMES
 1193  005476  001367                          BNE     T30             ;NO
 1194  005500  042777  000101  173272          BIC     #101,@CSR       ;YES--DISABLE INTERRUPTS
 1195  005506  032777  000001  173330          BIT     #1,@SR          ;
 1196  005514  001635                          BEQ     BEGIN1          ;
 1197                                  ;EXTERNAL (LINE FOR MAINTENANCE)
 1198  005516  013777  005570  173256          MOV     LINE,@CSB       ;INITIALZE COUNT SET BUFFER FOR 10 SECONDS
 1199  005524  012700  177772                  MOV     #-6,%0          ;COUNT 6 (10 SECOND) INTERVALS
 1200  005530  012777  000117  173242          MOV     #117,@CSR       ;EXT FREQ, REPEATED INTERRUPTS, INTERRUPT ENABLE , GO
 1201  005536  000001                  T31:    WAIT
 1202  005540  105777  173250                  TSTB    @TCSR
 1203  005544  100375                          BPL     .-4
 1204  005546  012777  000207  173236          MOV     #207,@TDBR      ;RING BELL
 1205  005554  005200                          INC     %0              ;DONE 6 TIMES
 1206  005556  001367                          BNE     T31             ;NO
 1207  005560  042777  000100  173212          BIC     #100,@CSR       ;YES, DISABLE INTERRUPTS
 1208  005566  000610                          BR      BEGIN1          ;REPEAT
 1209  005570  001130                  LINE:   600.
```

```
                                        .SBTTL          SUBROUTINES
                                        ;POWER FAIL HANDLERS
005572  012737  001150  005646  PWRF1:  MOV     #BEGIN,PWRRTN
005600  000403                        BR      PWRDWN
005602  012737  005210  005646  PWRF2:  MOV     #BEGIN1,PWRRTN
005610  012737  005620  000024  PWRDWN: MOV     #PWRUP,24
005616  000000                        HALT
005620  012706  000776          PWRUP:  MOV     #BUFF,%6
005624  005000                        CLR     %0
005626  005200                        INC     %0
005630  001376                        BNE     .-2
005632  012702  006472                MOV     #MSGPWR,%2
005636  004737  006266                JSR     %7,TOP
005642  000177  000000                JMP     @PWRRTN
006646  001150                  PWRRTN: BEGIN

                                        ;ENTERED WITH SYSTEM TRAP CALL (HLT)
                                        ;PRINT PC, STATUS REGISTER, COMAND REGISTER, BYTE COUNT, CURRENT ADDRESS,  DATA
005650  037727  173170  020000  PRINT:  BIT     @SR,#20000              ;TEST FOR INHIBIT PRINT OUT
005656  001401                        BEQ     .+4                     ;BRANCH TO PRINT
005660  000002                        RTI                             ;INHIBIT, RETURN TO MAIN STREAM
005662  012702  006370                MOV     #MSG1,%2
005666  005737  005764                TST     PRINT1
005672  001402                        BEQ     .+6
005674  012702  006432                MOV     #MSG2,%2
005700  004737  006266                JSR     %7,TOP                  ;PRINT ERROR HEADING
005704  005237  005764                INC     PRINT1
005710  011602                        MOV     (6),%2
005712  162702  000002                SUB     #2,%2
005716  004737  005766                JSR     %7,OCTPRT               ;PRINT PC
005722  017702  173052                MOV     @CSR,%2
005726  004737  005766                JSR     %7,OCTPRT               ;PRINT STATUS REGISTER
005732  017702  173046                MOV     @CTR,%2
005736  004737  005766                JSR     %7,OCTPRT               ;PRINT COUNTER
005742  013702  001020                MOV     TEMP,%2
005746  004737  005766                JSR     %7,OCTPRT               ;PRINT TEMP
005752  005777  173066                TST     @SR                     ;CHECK SR FOR HALT SWITCH
005756  100001                        BPL     .+4
005760  000000                        HALT                            ;HALT ON ERROR UP
005762  000002                        RTI                             ;RETURN TO MAINLINE
005764  000000                  PRINT1: 0
                                        ;PRINT OCTAL VALUE IN REGISTER2
005766  012737  000060  006100  OCTPRT: MOV     #'0,CHAR                ;INITIALIZE 1ST NUMBER AS 0
005774  005702                        TST     %2                      ;IS VALUE POSITIVE
005776  100003                        BPL     OCT1                    ;YES PRINT 0
006000  012737  000061  006100        MOV     #'1,CHAR                ;NO PRINT 1
006006  004737  006102          OCT1:   JSR     %7,OCTP
006012  006102                        ROL     %2
006014  006102                        ROL     %2
006016  012737  177773  006076        MOV     #-5,OCT                 ;COUNT 5 DIGITS
006024  006102                  OCT2:   ROL     %2
006026  006102                        ROL     %2
006030  006102                        ROL     %2
006032  010237  006100                MOV     %2,CHAR                 ;SAVE DIGIT
006036  042737  177770  006100        BIC     #177770,CHAR            ;CLEAR OTHER BITS
006044  052737  000060  006100        BIS     #60,CHAR                ;MAKE ASCII DIGIT
```

```
1266  006052  006002                        ROR     %2
1267  006054  004737  006102                JSR     %7,OCTP                 ;PRINT
1268  006060  006102                        ROL     %2
1269  006062  005237  006076                INC     OCT                     ;+1 TO DIGIT COUNT
1270  006066  001356                        BNE     OCT2                    ;NOT DONE
1271  006070  004737  006120                JSR     %7,SP3
1272  006074  000207                        RTS     %7                      ;EXIT
1273  006076  000000              OCT:      0
1274  006100  000000              CHAR:     0
1275  006102  105777  172706      OCTP:     TSTB    @TCSR
1276  006106  100375                        BPL     .-4                     ;WAIT FOR READY
1277  006110  013777  006100  172674        MOV     CHAR,@TDBR              ;PRINT
1278  006116  000207                        RTS     %7
1279                               ;TYPE 3 SPACES
1280  006120  012702  006132      SP3:      MOV     #SP3A,%2
1281  006124  004737  006266                JSR     %7,TOP
1282  006130  000207                        RTS     %7
1283  006132  020057  02          SP3A:     .ASCII  ;/  /;
1284                                        .EVEN
1285
1286  006136  022606              SCOPEB:   CMP     (6)+,%6                 ;REPOSITION THE STACK
1287  006140  012637  177776                MOV     (6)+,CC
1288  006144  000177  000114                JMP     @RETURN                 ;SCOPE RETURN
1289
1290                               ;SCOPE OR/AND ITERATION LOOP FOR EACH TEST
1291  006150  032777  040000  172666  SCOPEC:  BIT     #40000,@SR              ;TEST SR FOR SCOPE
1292  006156  001367                        BNE     SCOPEB                  ;YES SCOPE
1293  006160  005737  006252                TST     @#XORFLG
1294  006164  100011                        BPL     1$
1295  006166  013746  000004                MOV     @#4,-(%6)
1296  006172  012737  006254  000004        MOV     #XORA,@#4
1297  006200  005737  177060                TST     @#177060
1298  006204  012637  000004                MOV     (%6)+,@#4               ;RESTORE STACK
1299  006210  032777  004000  172626  1$:     BIT     #4000,@SR               ;NO - TEST FOR ITERATION
1300  006216  001007                        BNE     SCOPEG                  ;INHIBIT ITERATION
1301  006220  023737  006250  001022        CMP     SCOPEF,ICOUNT
1302  006226  001403                        BEQ     SCOPEG                  ;EXIT - DONE
1303  006230  005237  006250                INC     SCOPEF                  ;INCREMENT COUNT
1304  006234  000740                        BR      SCOPEB                  ;LOOP SOME MORE
1305  006236  005037  006250      SCOPEG:   CLR     SCOPEF                  ;CLEAR COUNT
1306  006242  011637  006264                MOV     @%6,RETURN              ;SAVE SCOPE RETURN POINTER
1307  006246  000002                        RTI                             ;RETURN INLINE-NEXT TEST
1308  006250  000000              SCOPEF:   0                               ;COUNT LOCATION FOR INTERATION LOOP
1309  006252  000000              XORFLG:   0
1310  006254  022626              XORA:     CMP     (%6)+,(%6)+
1311  006256  012637  000004                MOV     (%6)+,@#4
1312  006262  000725                        BR      SCOPEB
1313  006264  001150              RETURN:   BEGIN                           ;ADDRESS OF LAST TEST
1314                               ;MOV ADDRESS OF MESSAGE TO REGISTER 2
1315                               ;THEN JSR %7,TOP
1316  006266  142777  000177  172520  TOP:     BICB    #177,@TCSR              ;CLR INT FLAG
1317  006274  112237  006366                MOVB    (2)+,EOMK               ;MOVE IN EOM MARKER
1318  006300  121237  006366      TOP1:     CMPB    @%2,EOMK                ;COMPARE FOR EOM
1319  006304  001001                        BNE     .+4                     ;NO
1320  006306  000207                        RTS     %7                      ;YES, EXIT
1321  006310  121227  000100                CMPB    @%2,#'@
```

```
 1322  006314  001406                        BEQ     TOP2
 1323  006316  105777  172472                TSTB    @TCSR                   ;CK TTY
 1324  006322  100375                        BPL     .-4                     ;WAIT FOR DONE
 1325  006324  112277  172462                MOVB    (2)+,@TDBR              ;MOVE CHARACTER
 1326  006330  000763                        BR      TOP1                    ;BRANCH BACK
 1327  006332  105777  172456        TOP2:   TSTB    @TCSR
 1328  006336  100375                        BPL     .-4
 1329  006340  112777  000215  172444        MOVB    #215,@TDBR              ;SEND CARRIAGE RETURN
 1330  006346  105777  172442                TSTB    @TCSR
 1331  006352  100375                        BPL     .-4
 1332  006354  112777  000212  172430        MOVB    #212,@TDBR              ;SEND LINE FEED
 1333  006362  005202                        INC     %2                      ;INCRMTN R2
 1334  006364  000745                        BR      TOP1                    ;NO EOM, SO LOOP
 1335  006366     000          EOMK:   .BYTE   0
 1336          006370                        .EVEN
 1337  006370  040057  020040  041520  MSG1:   .ASCII  ;/@  PC    STATUS  COUNTER  TEMP@/;
 1338  006376  020040  020040  052123
 1339  006404  052101  051525  020040
 1340  006412  047503  047125  042524
 1341  006420  020122  052040  046505
 1342  006426  040120     057
 1343          006432                        .EVEN
 1344  006432  040057     057          MSG2:   .ASCII  ;/@/;
 1345          006436                        .EVEN
 1346  006436  040057  055103  053513  MSG3:   .ASCII  ;/@CZKWBJ KW11-P RT CLK TST@/;
 1347  006444  045102  045440  030527
 1348  006452  026461  020120  052122
 1349  006460  041440  045514  052040
 1350  006466  052123  027500
 1351                                        .EVEN
 1352  006472  040057  042522  052123  MSGPWR: .ASCII  ;/@RESTARTING AFTER A POWER FAILURE@@/;
 1353  006500  051101  044524  043516
 1354  006506  040440  052106  051105
 1355  006514  040440  050040  053517
 1356  006522  051105  043040  044501
 1357  006530  052514  042522  040100
 1358  006536     057
 1359          006540                        .EVEN
 1360  006540  040057  047531  020125  XORM:   .ASCII  ;/@YOU ARE ON AN XOR TESTER@/;
 1361  006546  051101  020105  047117
 1362  006554  040440  020116  047530
 1363  006562  020122  042524  052123
 1364  006570  051105  027500
 1365                                        .EVEN
 1366                                ;TIMER FOR KW11-P CLOCK
 1367                                ;
 1368  006574  172562                CSB1:   172562
 1369  006576  172560                CSR1:   172560
 1370  006600  172564                CTR1:   172564
 1371  006602  000504                CKV1:   504
 1372  006604  000506                CKVS1:  506
 1373  006606  000000                CLKFLG: 0
 1374  006610  000000                INTFLG: 0
 1375  006612  177566                PDBR:   177566
 1376  006614  177564                PCSR:   177564
 1377  006616  000064                PVEC:   64
```

```
1378  006620  000066                PVECS:  66
1379  006622  177562                KDBR:   177562
1380  006624  177560                KCSR:   177560
1381  006626  000060                KVEC:   60
1382  006630  000062                KVECS:  62
1383  006632  000000                CNT:    0
1384  006634  000000                CNT1:   0
1385  006636  000000                CNTB:   0
1386          000211                CTRLI=211
1387          000224                CTRLT=224
1388  006640  177776                PSW:    177776
1389  006642  000000                HRS1:   0
1390  006644  000000                HRS2:   0
1391  006646  000000                MIN1:   0
1392  006650  000000                MIN2:   0
1393  006652  000000                SEC1:   0
1394  006654  000000                SEC2:   0
1395  006656  000000                LST:    0
1396  006660  000000                MST:    0
1397  006662  000000                HRS1A:  0
1398  006664  000000                HRS2A:  0
1399  006666  000000                MIN1A:  0
1400  006670  000000                MIN2A:  0
1401  006672  000000                SEC1A:  0
1402  006674  000000                SEC2A:  0
1403  006676  000000                LSTA:   0
1404  006700  000000                MSTA:   0
1405  006702  000000                TMPSWR: 0               ;TEMP LOC FOR SOFT-SWR CONTENTS
1406  006704     000                BYT1:   .BYTE 0         ;LOC FOR 1ST # INPUT VIA TTY
1407  006705     000                BYT2:   .BYTE 0         ;  "   "  2ND  "   "   "   "
1408  006706     000                BYT3:   .BYTE 0         ;  "   "  3RD  "   "   "   "
1409  006707     000                BYT4:   .BYTE 0         ;  "   "  4TH  "   "   "   "
1410  006710     000                BYT5:   .BYTE 0         ;  "   "  5TH  "   "   "   "
1411  006711     000                BYT6:   .BYTE 0         ;  "   "  6TH  "   "   "   "
1412  006712     000                BYT7:   .BYTE 0         ;  "   "  7TH  "   "   "   "
1413          006714                .EVEN
1414
1415
1416
1417                                ;
1418  006714  012706  000776        K100HZ: MOV     #BUFF,%6                ;
1419  006720  004737  011652                JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
1420  006724  005077  177710                CLR     @PSW                    ;
1421  006730  012737  000000  007674        MOV     #0,CLK+2                ;100KHZ
1422  006736  012737  000131  007702        MOV     #131,CLK1+2
1423  006744  012700  010356                MOV     #TABL,%0
1424  006750  012701  010376                MOV     #TABL1,%1
1425  006754  004537  007234                JSR     %5,@#MOVE
1426  006760  012737  000043  010506        MOV     #35.,CLK3+2             ;LEAST VALUE
1427  006766  012737  001217  010536        MOV     #655.,CLK4+2            ;MOST VALUE
1428  006774  000137  007250                JMP     @#INIT
1429
1430  007000  012706  000776        K10HZ:  MOV     #BUFF,%6                ;
1431  007004  004737  011652                JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
1432  007010  005077  177624                CLR     @PSW                    ;
1433  007014  012737  164217  007674        MOV     #-13561,CLK+2           ;10KHZ
```

```
 1434  007022  012737  000133  007702          MOV     #133,CLK1+2
 1435  007030  012700  010356                  MOV     #TABL,%0
 1436  007034  012701  010416                  MOV     #TABL2,%1
 1437  007040  004537  007234                  JSR     %5,@#MOVE
 1438  007044  012737  000000  010506          MOV     #0.,CLK3+2
```

```
1439 007052 012737 001130 010536         MOV     #600.,CLK4+2
1440 007060 000137 007250                JMP     @#INIT
```

```
 1441
 1442  007064  012706  000776          H60Z:   MOV     #BUFF,%6                ;
 1443  007070  004737  011652                  JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
 1444  007074  005077  177540                  CLR     @PSW                    ;
```

```
 1445  007100  012737  177733  007674          MOV     #-45,CLK+2              ;60HZ
```

```
  1446  007106  012737  000135  007702          MOV     #135,CLK1+2
```

```
 1447  007114  012700  010356            MOV     #TABL,%0
 1448  007120  012701  010436            MOV     #TABL3,%1
 1449  007124  004537  007234            JSR     %5,a#MOVE
 1450  007130  012737  000000  010506    MOV     #00,CLK3+2
 1451  007136  012737  001130  010536    MOV     #600.,CLK4+2
 1452  007144  000137  007250            JMP     a#INIT
 1453
 1454  007150  012706  000776    H50Z:   MOV     #BUFF,%6        ;
 1455  007154  004737  011652            JSR     %7,SWADJ        ;HAS THIS CPU HAVE A SWITCH REG.?
 1456  007160  005077  177454            CLR     @PSW            ;
 1457  007164  012737  177742  007674    MOV     #-36,CLK+2              ;50HZ
 1458  007172  012737  000135  007702    MOV     #135,CLK1+2
 1459  007200  012700  010356            MOV     #TABL,%0
 1460  007204  012701  010456            MOV     #TABL4,%1
 1461  007210  004537  007234            JSR     %5,a#MOVE
 1462  007214  012737  000000  010506    MOV     #0.,CLK3+2
 1463  007222  012737  001104  010536    MOV     #580.,CLK4+2
 1464  007230  000137  007250            JMP     a#INIT
 1465
 1466  007234  012702  177771    MOVE:   MOV     #-7,%2
 1467  007240  012120            1$:     MOV     (%1)+,(%0)+
 1468  007242  005202                    INC     %2
 1469  007244  001375                    BNE     1$
 1470  007246  000205                    RTS     %5
 1471
 1472  007250  013737  005572  000024  INIT:   MOV     PWRF1,24        ;
 1473  007256  012706  000776            MOV     #BUFF,%6                ;INITIALIZE
 1474  007262  005037  006656            CLR     a#LST
 1475  007266  005037  006660            CLR     a#MST
 1476  007272  012737  000060  006642    MOV     #60,a#HRS1
 1477  007300  012737  000060  006644    MOV     #60,a#HRS2
 1478  007306  012737  000060  006646    MOV     #60,a#MIN1
 1479  007314  012737  000060  006650    MOV     #60,a#MIN2
 1480  007322  012737  000060  006652    MOV     #60,a#SEC1
 1481  007330  012737  000060  006654    MOV     #60,a#SEC2
 1482  007336  012777  010476  171442    MOV     #CLKI,@CKV
 1483  007344  012777  000340  171436    MOV     #340,@CKVS
 1484  007352  012777  007560  177246    MOV     #KINTR,@KVEC
 1485  007360  012777  000200  177242    MOV     #200,@KVECS
 1486  007366  012777  000200  177224    MOV     #200,@PVECS
 1487  007374  012777  000100  177222    MOV     #100,@KCSR
 1488  007402  005037  006606            CLR     a#CLKFLG
 1489  007406  005037  006610            CLR     a#INTFLG
 1490  007412  005077  171362    START:  CLR     @CSR
 1491  007416  005077  171360            CLR     @CSB
 1492  007422  032777  000002  171414    BIT     #2,@SR                  ;WAIT LOOP, SW 1 CAUSE WAIT
 1493  007430  001401                    BEQ     CLKON
 1494  007432  000001            WAITB:  WAIT
 1495  007434  032777  000001  171402    BIT     #1,@SR                  ;SW 0 TURNS ON CLK2
 1496  007442  001032                    BNE     3$
 1497  007444  032777  000004  171372    BIT     #4,@SR                  ;SW 2 DETERMINES PRESENCE OF CLOCK 2
 1498  007452  001426                    BEQ     3$
 1499  007454  005737  006606            TST     a#CLKFLG                ;CLKFLG ALLOW CLK 2 TO BE TURNED ON
 1500  007460  001360                    BNE     WAITA                   ;ONLY ONCE
 1501  007462  005077  177106            CLR     @CSB1
 1502  007466  012777  007762  177106    MOV     #KOUT,@CKV1
```

```
 1503  007474  012777  000200  177102          MOV     #200,@CKVS1
 1504  007502  012737  177777  006606          MOV     #-1,@#CLKFLG
 1505  007510  012777  141521  177056          MOV     #141521,@CSB1
 1506  007516  012777  000113  177052          MOV     #113,@CSR1              ;TURN ON CLK 2
 1507  007524  000137  007432                  JMP     WAITB
 1508  007530  005037  006606          3$:     CLR     @#CLKFLG                ;CLEAR CLK 2 IF PRESENT
 1509  007534  032777  000004  171302          BIT     #4,@SR
 1510  007542  001404                          BEQ     4$
 1511  007544  005077  177026                  CLR     @CSR1
 1512  007550  005077  177020                  CLR     @CSB1
 1513  007554  000137  007422          4$:     JMP     WAITA
 1514
 1515  007560  017701  177036          KINTR:  MOV     @KDBR,%1                ;KEYBOARD INTERRUPT HANDLER
 1516  007564  042701  177600                  BIC     #177600,%1              ;STRIP JUNK
 1517  007570  022701  000007                  CMP     #7,%1           ;IS CHAR A  G(CONTROL-G)?
 1518  007574  001557                          BEQ     CNGSWR          ;IF YES,GO TO CNGSWR
 1519  007576  022701  000011                  CMP     #11,%1          ;IS IT A CNTRL I ?
 1520  007602  001404                          BEQ     KIN
 1521  007604  022701  000024                  CMP     #24,%1          ;IS IT A CNTRL T ?
 1522  007610  001464                          BEQ     KOUT
 1523  007612  000002                          RTI
 1524
 1525
 1526  007614  005077  171160          KIN:    CLR     @CSR                    ;HANDLER FOR CTRL I
 1527  007620  005077  171156                  CLR     @CSB                    ;SETUP TIME OF DAY
 1528  007624  012737  177772  006632          MOV     #-6,@#CNT
 1529  007632  012737  006642  006634          MOV     #HRS1,@#CNT1            ;INPUT
 1530  007640  005037  006656                  CLR     LST
 1531  007644  005037  006660                  CLR     MST
 1532  007650  012777  007710  176750          MOV     #KINI,@KVEC
 1533  007656  000002                          RTI
 1534
 1535  007660  012777  007560  176740  KINI2:  MOV     #KINTR,@KVEC            ;AWAIT A CHAR TO START
 1536  007666  017701  176730                  MOV     @KDBR,%1
 1537  007672  012777  000000  171102  CLK:    MOV     #0,@CSB                 ;CLK 1
 1538  007700  012777  000131  171072  CLK1:   MOV     #131,@CSR
 1539  007706  000002                          RTI
 1540
 1541  007710  013704  006634          KINI:   MOV     @#CNT1,%4               ;STORE TIME OF DAY
 1542  007714  017701  176702                  MOV     @KDBR,%1
 1543  007720  042701  000300                  BIC     #300,%1
 1544  007724  010124                          MOV     %1,(%4)+
 1545  007726  010437  006634                  MOV     %4,@#CNT
 1546  007732  005237  006632                  INC     @#CNT
 1547  007736  001003                          BNE     1$
 1548  007740  012777  007660  176660          MOV     #KINI2,@KVEC
 1549  007746  000002                  1$:     RTI
 1550
 1551  007750  017737  176646  007760  HOLDIT: MOV     @KDBR,@#HOLD            ;DUMMY INTERRUPT SERVICE ROUTINE
 1552  007756  000002                          RTI
 1553
 1554  007760  000000                  HOLD:   0
 1555
 1556  007762  005037  006610          KOUT:   CLR     @#INTFLG                ;INPUT HANDLER FOR CTRL T
 1557  007766  012777  007750  176632          MOV     #HOLDIT,@KVEC           ;SET DUMMY VECTOR
 1558  007774  012700  006642                  MOV     #HRS1,%0                ;GET TIME OF DAY INTO
```

```
 1559  010000  012703  006662                MOV     #HRS1A,%3               ;WORK AREA
 1560  010004  012704  177770                MOV     #-10,%4
 1561  010010  012023                1$:     MOV     (%0)+,(%3)+
 1562  010012  005204                        INC     %4
 1563  010014  001375                        BNE     1$
 1564  010016  017701  170762                MOV     @CTR,%1
 1565  010022  005737  006610                TST     @#INTFLG                ;SEE IF CLK HAS INTERRUPTED IN THIS TIME
 1566  010026  001355                        BNE     KOUT                    ;CALC VALUE OF CTR
 1567  010030  005737  007674                TST     @#CLK+2                 ;IS CLOCK RUNNING AT 100KHZ ?
 1568  010034  001416                        BEQ     2$
 1569  010036  163701  007674                SUB     @#CLK+2,%1              ;SUB INIT VALUE
 1570  010042  006301                        ASL     %1
 1571  010044  006301                        ASL     %1
 1572  010046  023727  007674  164217        CMP     @#CLK+2,#-13561         ;IS CLOCK RUNNING AT 10KHZ ?
 1573  010054  001405                        BEQ     3$
 1574  010056  000301                10$:    SWAB    %1
 1575  010060  023727  007674  177742        CMP     @#CLK+2,#-36            ;IS CLOCK RUNNING AT 50HZ ?
 1576  010066  001001                        BNE     2$
 1577  010070  006301                3$:     ASL     %1
 1578  010072  005000                2$:     CLR     %0
 1579  010074  005003                        CLR     %3
 1580  010076  012704  010356          5$:   MOV     #TABL,%4
 1581  010102  005701                6$:     TST     %1
 1582  010104  100001                        BPL     4$
 1583  010106  061403                        ADD     @%4,%3
 1584  010110  006301                4$:     ASL     %1
 1585  010112  005724                        TST     (%4)+
 1586  010114  005200                        INC     %0
 1587  010116  022700  000007                CMP     #7,%0
 1588  010122  001367                        BNE     6$
 1589  010124  060337  006700                ADD     %3,@#MSTA               ;ADD VALUE OF CTR TO MST
 1590  010130  000137  010772                JMP     @#CLK2
 1591  010134                        CNGSWR:
 1592  010134  010246                        MOV     %2,-(6)         ;SAVE R2
 1593  010136  010346                        MOV     %3,-(6)         ;SAVE R3
 1594  010140                        SETBYT:
 1595  010140  005037  006702                CLR     TMPSWR          ;CLEAR TEMP SWR
 1596  010144  005003                        CLR     %3              ;CLEAR R3
 1597  010146  004737  010324                JSR     PC,CRLF         ;PRINT <CR><LF>
 1598  010152  012702  006704                MOV     #BYT1,%2        ;INIT R2 TO 1ST BYTE LOC
 1599  010156                        CKCSR:
 1600  010156  105777  176442                TSTB    @KCSR           ;IS CHAR TYPED?
 1601  010162  100375                        BPL     CKCSR           ;IF NOT,WAIT
 1602  010164  017701  176432                MOV     @KDBR,%1        ,ELSE MOVE THE CHAR TO R1
 1603  010170  042701  177600                BIC     #177600,%1      ;STRIP JUNK
 1604  010174                        5$:
 1605  010174  105777  176414                TSTB    @PCSR
 1606  010200  100375                        BPL     5$
 1607  010202  010177  176404                MOV     %1,@PDBR
 1608  010206  122701  000025                CMPB    #25,%1          ;IS CHAR  U (CONTROL-U)?
 1609  010212  001752                        BEQ     SETBYT          ;IF YES,START OVER
 1610  010214  122701  000015                CMPB    #15,%1          ;ELSE IS IT <CR>?
 1611  010220  001412                        BEQ     SWDONE          ;IF EQUAL,GO TO SWDONE
 1612  010222  122701  000012                CMPB    #12,%1          ;IS IT <LF>?
 1613  010226  001407                        BEQ     SWDONE          ;IF EQUAL,GO TO SWDONE
 1614  010230  005203                        INC     %3              ;INDICATE A CHAR INPUTTED
```

```
 1615  010232  042701  177770            BIC     #177770,%1      ;LEAVE ONLY BINARY # IN R1
 1616  010236  110122                    MOVB    %1,(2)+         ;MOVE # TO PROPER BYTE LOC
 1617  010240  022702  006712            CMP     #BYT7,%2        ;IS R2 PAST BYT6 ADDR?
 1618  010244  001344                    BNE     CKCSR           ;IF NOT,GO BACK FOR ANOTHER CHAR
 1619  010246                    SWDONE:
 1620  010246  005703                    TST     %3              ;WAS A CHAR TYPED?
 1621  010250  001420                    BEQ     30$             ;IF NOT,EXIT
 1622  010252  012703  006704            MOV     #BYT1,%3        ;INIT R3 TO 1ST BYTE ADDR
 1623  010256                    10$:
 1624  010256  152337  006702            BISB    (3)+,TMPSWR     ;SET LOW 3 BITS OF TMPSWR
 1625  010262  020302                    CMP     %3,%2           ;IS R3 EQUAL BYTE ADDR IN R2?
 1626  010264  001407                    BEQ     20$             ;IF YES ,EXIT
 1627  010266  006137  006702            ROL     TMPSWR          ;ELSE
 1628  010272  006137  006702            ROL     TMPSWR          ;SHIFT
 1629  010276  006137  006702            ROL     TMPSWR          ;NEXT 3 BITS UP
 1630  010302  000765                    BR      10$             ;AND GO GET ANOTHER #
 1631  010304                    20$:
 1632  010304  013777  006702  170532    MOV     TMPSWR,@SR      ;SET UP NEW SWR
 1633  010312                    30$:
 1634  010312  012603                    MOV     (6)+,%3         ;RESTORE R3
 1635  010314  012602                    MOV     (6)+,%2         ;RESTORE R2
 1636  010316  004737  010324            JSR     PC,CRLF         ;PRINT <CR><LF>
 1637  010322  000002                    RTI
 1638
 1639  010324                    CRLF:
 1640  010324  105777  176264            TSTB    @PCSR           ;IS TTY READY?
 1641  010330  100375                    BPL     CRLF            ;IF NOT,WAIT
 1642  010332  012777  000215  176252    MOV     #215,@PDBR      ;ELSE TYPE <CR>
 1643  010340                    10$:
 1644  010340  105777  176250            TSTB    @PCSR           ;IS TTY READY?
 1645  010344  100375                    BPL     10$             ;IF NOT,WAIT
 1646  010346  012777  000212  176236    MOV     #212,@PDBR      ;ELSE TYPE <LF>
 1647  010354  000207                    RTS     PC
 1648
 1649  010356  000510            TABL:   328.                    ;TABLE FOR WORK AREA
 1650  010360  000244                    164.
 1651  010362  000122                    82.
 1652  010364  000051                    41.
 1653  010366  000024                    20.
 1654  010370  000012                    10.
 1655  010372  000005                    5.
 1656  010374  000003                    3.
 1657
 1658  010376  000510            TABL1:  328.                    ;100KHZ TIME TABLE
 1659  010400  000244                    164.
 1660  010402  000122                    82.
 1661  010404  000051                    41.
 1662  010406  000024                    20.
 1663  010410  000012                    10.
 1664  010412  000005                    5.
 1665  010414  000003                    3.
 1666
 1667  010416  000632            TABL2:  410.                    ;10KHZ TIME TABLE
 1668  010420  000315                    205.
 1669  010422  000146                    102.
 1670  010424  000063                    51.
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```
 1671  010426  000032                          26.
 1672  010430  000015                          13.
 1673  010432  000006                          6.
 1674  010434  000003                          3.
 1675
 1676  010436  001025                  TABL3:  533.                    ;60HZ TIME TABLE
 1677  010440  000413                          267.
 1678  010442  000205                          133.
 1679  010444  000103                          67.
 1680  010446  000041                          33.
 1681  010450  000021                          17.
 1682  010452  000000                          0.
 1683  010454  000000                          0.
 1684
 1685  010456  000500                  TABL4:  320.                    ;50HZ TIME TABLE
 1686  010460  000240                          160.
 1687  010462  000120                          80.
 1688  010464  000050                          40.
 1689  010466  000024                          20.
 1690  010470  000000                          0.
 1691  010472  000000                          0.
 1692  010474  000000                          0.
 1693
 1694                                  ;THIS ROUTINE KEEPS THE 24 HOUR
 1695                                  ;TIME OF DAY
 1696
 1697  010476  012737  177777  006610  CLKI:   MOV     #-1,@#INTFLG            ;CLOCK INTERRUPT SERVICE ROUTINE
 1698  010504  062737  000044  006656  CLK3:   ADD     #36.,@#LST              ;ADD LSB TO LST
 1699  010512  022737  000144  006656          CMP     #100.,@#LST             ;DID IT OVER FLOW
 1700  010520  003005                          BGT     CLK4
 1701  010522  162737  000144  006656          SUB     #100.,@#LST             ;YES
 1702  010530  005237  006660                  INC     @#MST                   ;INC MST
 1703  010534  062737  001217  006660  CLK4:   ADD     #655.,@#MST             ;ADD MSB TO MST
 1704  010542  022737  001750  006660          CMP     #1000.,@#MST            ;DID IT OVER FLOW
 1705  010550  003011                          BGT     2$
 1706  010552  162737  001750  006660          SUB     #1000.,@#MST            ;YES
 1707  010560  005237  006654                  INC     @#SEC2                  ;INC SECOND
 1708  010564  022737  000072  006654          CMP     #72,@#SEC2              ;HAS 10 SECONDS ELAPSED
 1709  010572  001401                          BEQ     .+4
 1710  010574  000002                  2$:     RTI
 1711  010576  012737  000060  006654          MOV     #60,@#SEC2              ;YES
 1712  010604  005237  006652                  INC     @#SEC1                  ;INC MSB OF SECOND
 1713  010610  022737  000066  006652          CMP     #66,@#SEC1              ;HAS 60 MIN ELAPSED
 1714  010616  001401                          BEQ     .+4
 1715  010620  000002                          RTI
 1716  010622  012737  000060  006652          MOV     #60,@#SEC1              ;YES
 1717  010630  005237  006650                  INC     @#MIN2                  ;INC LSB OF MIN
 1718  010634  022737  000072  006650          CMP     #72,@#MIN2              ;HAS 10 MIN ELAPSED
 1719  010642  001401                          BEQ     .+4
 1720  010644  000002                          RTI
 1721  010646  012737  000060  006650          MOV     #60,@#MIN2
 1722  010654  005237  006646                  INC     @#MIN1                  ;INC MSB OF MIN
 1723  010660  022737  000066  006646          CMP     #66,@#MIN1              ;HAS 60 MIN ELAPSED
 1724  010666  001401                          BEQ     .+4
 1725  010670  000002                          RTI
 1726  010672  012737  000060  006646          MOV     #60,@#MIN1
```

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 1727  010700  005237  006644                    INC     a#HRS2                  ;INC LSB OF HOURS
 1728  010704  022737  000064  006644            CMP     #64,a#HRS2              ;IS LSB A 4
 1729  010712  001014                            BNE     NEWTM
 1730  010714  022737  000062  006642            CMP     #62,a#HRS1              ;IF YES, IS MSB A 2
 1731  010722  001401                            BEQ     .+4
 1732  010724  000002                            RTI
 1733  010726  012737  000060  006642            MOV     #60,a#HRS1              ;IF 24 HOURS RESET
 1734  010734  012737  000060  006644            MOV     #60,a#HRS2              ;LSB AND MSB OF HOURS
 1735  010742  000002                            RTI
 1736  010744  022737  000072  006644  NEWTM:    CMP     #72,a#HRS2              ;IF NOT 4 IS IT 10 HOURS
 1737  010752  001401                            BEQ     .+4
 1738  010754  000002                            RTI
 1739  010756  005237  006642                    INC     a#HRS1                  ;YES INC MSB OF HOURS
 1740  010762  012737  000060  006644            MOV     #60,a#HRS2
 1741  010770  000002                            RTI
 1742
 1743
 1744
 1745
 1746  010772  022737  001750  006700  CLK2:     CMP     #1000.,a#MSTA           ;THIS ROUTINE IS THE WORK
 1747  011000  003011                            BGT     2$
 1748  011002  162737  001750  006700            SUB     #1000.,a#MSTA           ;AREA ROUTINE AND IS THE
 1749  011010  005237  006674                    INC     a#SEC2A                 ;SAME AS INTERRUPT HANDLER
 1750  011014  022737  000072  006674            CMP     #72,a#SEC2A             ;SERVICE ROUTINE
 1751  011022  001401                            BEQ     .+4
 1752  011024  000475                  2$:       BR      END1A
 1753  011026  012737  000060  006674            MOV     #60,a#SEC2A
 1754  011034  005237  006672                    INC     a#SEC1A
 1755  011040  022737  000066  006672            CMP     #66,a#SEC1A
 1756  011046  001401                            BEQ     .+4
 1757  011050  000463                            BR      END1A
 1758  011052  012737  000060  006672            MOV     #60,a#SEC1A
 1759  011060  005237  006670                    INC     a#MIN2A
 1760  011064  022737  000072  006670            CMP     #72,a#MIN2A
 1761  011072  001401                            BEQ     .+4
 1762  011074  000451                            BR      END1A
 1763  011076  012737  000060  006670            MOV     #60,a#MIN2A
 1764  011104  005237  006666                    INC     a#MIN1A
 1765  011110  022737  000066  006666            CMP     #66,a#MIN1A
 1766  011116  001401                            BEQ     .+4
 1767  011120  000437                            BR      END1A
 1768  011122  012737  000060  006666            MOV     #60,a#MIN1A
 1769  011130  005237  006664                    INC     HRS2A
 1770  011134  022737  000064  006664            CMP     #64,a#HRS2A
 1771  011142  001014                            BNE     NEWT
 1772  011144  022737  000062  006662            CMP     #62,a#HRS1A
 1773  011152  001401                            BEQ     .+4
 1774  011154  000421                            BR      END1A
 1775  011156  012737  000060  006662            MOV     #60,a#HRS1A
 1776  011164  012737  000060  006664            MOV     #60,a#HRS2A
 1777  011172  000412                            BR      END1A
 1778  011174  022737  000072  006664  NEWT:     CMP     #72,a#HRS2A
 1779  011202  001401                            BEQ     .+4
 1780  011204  000405                            BR      END1A
 1781  011206  005237  006662                    INC     a#HRS1A
 1782  011212  012737  000060  006664            MOV     #60,a#HRS2A
```

```
 1783  011220  012777  011266  175370  END1A:  MOV   #CR,@PVEC          ;SET UP FOR PRINTER OUTPUT
 1784  011226  012737  177776  006636          MOV   #-2,@#CNTB
 1785  011234  012737  006662  006634          MOV   #HRS1A,@#CNT1
 1786  011242  012737  177767  006632          MOV   #-11,@#CNT
 1787  011250  012777  000000  175334          MOV   #0,@PDBR
 1788  011256  012777  000100  175330          MOV   #100,@PCSR
 1789  011264  000002                          RTI
 1790
 1791
 1792  011266  012777  011304  175322  CR:     MOV   #LF,@PVEC           ;OUTPUT CR
 1793  011274  012777  000215  175310          MOV   #215,@PDBR
 1794  011302  000002                          RTI
 1795
 1796  011304  012777  011322  175304  LF:     MOV   #PINTR,@PVEC        ;OUTPUT LF
 1797  011312  012777  000212  175272          MOV   #212,@PDBR
 1798  011320  000002                          RTI
 1799  011322  005237  006632          PINTR:  INC   @#CNT               ;PRINT TWO DIGITS FOLLOWED
 1800  011326  001414                          BEQ   DONE                ;BY COLON UNTIL TIME OF
 1801  011330  005737  006636                  TST   CNTB                ;DAY IS PRINTED
 1802  011334  001420                          BEQ   COLON
 1803  011336  013704  006634                  MOV   @#CNT1,%4
 1804  011342  012477  175244                  MOV   (%4)+,@PDBR
 1805  011346  010437  006634                  MOV   %4,@#CNT1
 1806  011352  005237  006636                  INC   @#CNTB
 1807  011356  000002                          RTI
 1808  011360  012777  011414  175230  DONE:   MOV   #PER,@PVEC          ;WHEN DONE PRINT "."
 1809  011366  012777  000056  175216          MOV   #56,@PDBR
 1810  011374  000002                          RTI
 1811
 1812  011376  012737  177776  006636  COLON:  MOV   #-2,@#CNTB
 1813  011404  012777  000072  175200          MOV   #72,@PDBR
 1814  011412  000002                          RTI
 1815
 1816  011414  005037  006636          PER:    CLR   @#CNTB              ;PRINT MSB OF MILLISEC
 1817  011420  000250                          CLN
 1818  011422  013737  006700  006634          MOV   @#MSTA,@#CNT1
 1819  011430  012737  177767  006632          MOV   #-9.,@#CNT
 1820  011436  162737  000144  006634  1$:     SUB   #100.,@#CNT1
 1821  011444  100406                          BMI   2$
 1822  011446  005237  006636                  INC   @#CNTB
 1823  011452  005237  006632                  INC   @#CNT
 1824  011456  001367                          BNE   1$
 1825  011460  000404                          BR    3$
 1826  011462  062737  000144  006634  2$:     ADD   #100.,@#CNT1
 1827  011470  000250                          CLN
 1828  011472  062737  000060  006636  3$:     ADD   #60,@#CNTB
 1829  011500  012777  011516  175110          MOV   #NUM1,@PVEC
 1830  011506  013777  006636  175076          MOV   @#CNTB,@PDBR
 1831  011514  000002                          RTI
 1832
 1833  011516  012777  011600  175072  NUM1:   MOV   #NUM2,@PVEC          ;PRINT LSB OF MILLISEC
 1834  011524  005037  006636                  CLR   @#CNTB
 1835  011530  000250                          CLN
 1836  011532  012737  177767  006632          MOV   #-9.,@#CNT
 1837  011540  162737  000012  006634  1$:     SUB   #10.,@#CNT1
 1838  011546  100405                          BMI   3$
```

```
 1839  011550  005237  006636                INC     @#CNTB
 1840  011554  005237  006632                INC     @#CNT
 1841  011560  001367                        BNE     1$
 1842  011562  062737  000060  006636  3$:   ADD     #60,@#CNTB
 1843  011570  013777  006636  175014        MOV     @#CNTB,@PDBR
 1844  011576  000002                        RTI
 1845
 1846  011600  012777  007560  175020  NUM2: MOV     #KINTR,@KVEC            ;RESTORE KEYBOARD VECTOR
 1847  011606  000002                        RTI
 1848
 1849
 1850
 1851
 1852
 1853
 1854  011610  032777  000010  167226  DELADJ: BIT    #10,@SR                 ;TEST FOR SR3=0 WHICH INDICATES
 1855                                                                          ;11/60, 11/70 &11/45 WITH MOS
 1856  011616  001401                        BEQ     1$                      ;ADJUST DELAY TIMES
 1857  011620  000207                        RTS     %7                      ;NO ADJUSTMENTS REQUIRED
 1858  011622  012701  001034          1$:   MOV     #ADJ,R1                 ;GET START OF REG. FOR ADJUST
 1859  011626  012700  001024                MOV     #DEL1,R0                ;GET START OF REG. TO ADJUST
 1860  011632  012702  001032                MOV     #DEL4,R2                ;GET END TAG OF ADJUSTMENT
 1861  011636  062702  000002                ADD     #2,R2                   ;UPDATE END CHECK
 1862  011642  012120                  2$:   MOV     (R1)+,(R0)+             ;UPDATE DELAY COUNTS
 1863  011644  020200                        CMP     R2,R0                   ;ARE WE DONE
 1864  011646  001375                        BNE     2$                      ;NO CONTINUE UPDATE
 1865  011650  000207                        RTS     %7                      ;ADJUSTMENT MADE
 1866
 1867  011652  013746  000004          SWADJ: MOV     @#4,-(%6)               ;SAVE CONTENT OF TRAP
 1868                                                                          ;VECTOR
 1869  011656  012737  011676  000004        MOV     #SWADJ1,@#4             ;SET UP NEW TRAP VECTOR
 1870  011664  005777  167154                TST     @SR                     ;TEST FOR SWITCH REG.
 1871  011670  012637  000004                MOV     (%6)+,@#4               ;RESTORE STACK NO
 1872                                                                          ;TIME OUT ACCONED.
 1873  011674  000207                        RTS     %7
 1874
 1875  011676  022626                  SWADJ1: CMP     (%6)+,(%6)+             ;UPDATE STACK
 1876  011700  012637  000004                MOV     (%6)+,@#4               ;RESTORE TRAP VECTOR
 1877  011704  012737  000176  001044        MOV     #SOFTSR,SR              ;SET SWITCH REG.(SR) TO
 1878                                                                          ;EQUAL SOFTSR
 1879  011712  000207                        RTS     %7                      ;RETURN TO CALLER
 1880
 1881
 1882
 1883          000001                  .END
```

```
ADJ     001034          474#  1858
BEGIN   001150          452    500#   516   1134   1212   1224   1313
BEGIN1  005210          453   1143#  1179   1196   1208   1214
BEGIN2  001046          451    484#
BUFF  = 000776          449#   484    500    850    865    880    895   1143   1217   1418   1430   1442   1454
                       1473
BYT1    006704         1406#  1598   1622
BYT2    006705         1407#
BYT3    006706         1408#
BYT4    006707         1409#
BYT5    006710         1410#
BYT6    006711         1411#
BYT7    006712         1412#  1617
CACL    004446         1016   1027#  1058   1083
CC    = 177776          445#   629*   830*   853*   868*   884*  1088*  1104*  1287*
CHAR    006100         1252*  1255*  1263*  1264*  1265*  1274#  1277
CKCSR   010156         1599#  1601   1618
CKV     001006          463#   834*   854*   869*   887*   899*   948    952*   975*  1145*  1482*
CKVS    001010          464#   831*   953*  1145   1146*  1483*
CKVS1   006604         1372#  1503*
CKV1    006602         1371#  1502*
CLK     007672         1421*  1433*  1445*  1457*  1537#  1567   1569   1572   1575
CLKFLG  006606         1373#  1488*  1499   1504*  1508*
CLKI    010476         1482   1697#
CLKON   007434         1493   1495#
CLKSER  004240          952    979#
CLKXIT  004244          981#
CLK1    007700         1422*  1434*  1446*  1458*  1538#
CLK2    010772         1590   1746#
CLK3    010504         1426*  1438*  1450*  1462*  1698#
CLK4    010534         1427*  1439*  1451*  1463*  1700   1703#
CNGSWR  010134         1518   1591#
CNT     006632          951*   972*   973   1383#  1528*  1546*  1786*  1799*  1819*  1823*  1836*  1840*
CNTB    006636         1385#  1784*  1801   1806*  1812*  1816*  1822*  1828*  1830   1834*  1839*  1842*  1843
CNT1    006634         1384#  1529*  1541   1545*  1785*  1803   1805*  1818*  1820*  1826*  1837*
COLON   011376         1802   1812#
CR      011266         1783   1792#
CRLF    010324         1597   1636   1639#  1641
CSB     001002          461#   536*   537    549*   558*   568*   582*   643*   651*   660*   672*   685*   698*
                        714*   731*   748*   765*   780*   797*   815*   833*   856*   871*   886*   900*   927*
                        954*  1001*  1009*  1043*  1051*  1068*  1076*  1089*  1105*  1150*  1164*  1185*  1198*
                       1491*  1527*  1537*
CSB1    006574         1021*  1368#  1501*  1505*  1512*
CSR     001000          460#   521*   523    557*   567*   571*   572    573*   574    589*   590    593*   594
                        597*   598    601*   602    607*   608    611*   612    617*   618    621*   622    630*
                        631    634*   635    641*   644*   645    649*   652*   653*   654    658*   661*   662*
                        663    671*   674*   684*   687*   697*   699*   701    705*   713*   715*   717    721*
                        730*   732*   734    738*   747*   749*   751    755*   764*   766*   768    772*   779*
                        781*   783    787*   796*   798*   800    804*   814*   816*   818    822*   832*   835*
                        839*   842    849*   855*   857*   861*   864*   870*   872*   876*   878*   885*   888*
                        892*   894*   901*   905*   911*   928*   935*   955*   976*  1000*  1002*  1004   1008*
                       1010*  1012   1042*  1044*  1046   1050*  1052*  1054   1067*  1069*  1071   1075*  1077*
                       1079   1087*  1090*  1094   1096*  1098*  1099   1106*  1110   1112*  1115   1153*  1162*
                       1167*  1176*  1187*  1194*  1200*  1207*  1240   1490*  1526*  1538*
CSRT    001312          520    527#
CSR1    006576         1020*  1022*  1023   1369#  1506*  1511*
```

CTR	001004	462#	541*	542	550	562	577	584	675	688	707	723	740	757
		774	789	806	825	929	1007	1015	1049	1057	1074	1082	1242	1564
CTRLI =	000211	1386#												
CTRLT =	000224	1387#												
CTR1	006600	1370#												
DELADJ	011610	490	502	1854#										
DELY	004416	1003	1011	1020#	1045	1053	1070	1078						
DEL1	001024	470#	700	767	836	858	873	889	902	1091	1107	1859		
DEL2	001026	471#	716	782										
DEL3	001030	472#	559	569	733	799								
DEL4	001032	473#	750	817	1860									
DONE	011360	1800	1808#											
END1A	011220	1752	1757	1762	1767	1774	1777	1780	1783#					
EOMK	006366	1317*	1318	1335#										
HLT -	104000	444#	525	539	544	552	564	579	586	592	596	600	604	610
		614	620	624	633	637	647	656	665	677	690	706	709	722
		725	739	742	756	759	773	776	788	791	805	808	823	827
		840	845	848	862	879	893	906	933	966	1006	1014	1017	1048
		1056	1059	1073	1081	1084	1097	1101	1113	1117				
HOLD	007760	1551*	1554#											
HOLDIT	007750	1551#	1557											
HRS1	006642	1389#	1476*	1529	1558	1730	1733*	1739*						
HRS1A	006662	1397#	1559	1772	1775*	1781*	1785							
HRS2	006644	1390#	1477*	1727*	1728	1734*	1736	1740*						
HRS2A	006664	1398#	1769*	1770	1776*	1778	1782*							
H50Z	007150	457	1454#											
H60Z	007064	456	1442#											
ICOUNT	001022	469#	496*	514*	1301									
INIT	007250	1428	1440	1452	1464	1472#								
INTFLG	006610	1374#	1489*	1556*	1565	1697*								
KCSR	006624	1380#	1487*	1600										
KDBR	006622	1379#	1515	1536	1542	1551	1602							
KIN	007614	1520	1526#											
KINI	007710	1532	1541#											
KINI2	007660	1535#	1548											
KINTR	007560	1484	1515#	1535	1846									
KOUT	007762	1502	1522	1556#	1566									
KVEC	006626	1381#	1484*	1532*	1535*	1548*	1557*	1846*						
KVECS	006630	1382#	1485*											
K10HZ	007000	455	1430#											
K100HZ	006714	454	1418#											
LF	011304	1792	1796#											
LINE	005570	1180*	1183*	1185	1198	1209#								
LOGICA	005174	443	1130#											
LOOP	004152	958#	974											
LST	006656	1395#	1474*	1530*	1698*	1699	1701*							
LSTA	006676	1403#												
MIN1	006646	1391#	1478*	1722*	1723	1726*								
MIN1A	006666	1399#	1764*	1765	1768*									
MIN2	006650	1392#	1479*	1717*	1718	1721*								
MIN2A	006670	1400#	1759*	1760	1763*									
MOVE	007234	1425	1437	1449	1461	1466#								
MSGPWR	006472	1221	1352#											
MSG1	006370	1231	1337#											
MSG2	006432	1234	1344#											
MSG3	006436	487	1346#											

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MST     006660          1396#  1475*  1531*  1702*  1703*  1704   1706*
MSTA    006700          1404#  1589*  1746   1748*  1818
NEWT    011174          1771   1778#
NEWTM   010744          1729   1736#
NOP   = 000240           446#
NUM1    011516          1829   1833#
NUM2    011600          1833   1846#
OCT     006076          1259*  1269*  1273#
OCTP    006102          1256   1267   1275#
OCTPRT  005766          1239   1241   1243   1245   1252#
OCT1    006006          1254   1256#
OCT2    006024          1260#  1270
PCSR    006614          1376#  1605   1640   1644   1788*
PDBR    006612          1375#  1607*  1642*  1646*  1787*  1793*  1797*  1804*  1809*  1813*  1850*  1843*
PER     011414          1808   1816#
PINTR   011322          1796   1799#
PRINT   005650           438   1228#
PRINT1  005764           509*  1232   1236*  1250#
PSW     006640           504*   949*   959*   961*  1388#  1420*  1432*  1444*  1456*
PVEC    006616          1377#  1783*  1792*  1796*  1808*  1829*  1833*
PVECS   006620          1378#  1486*
PWRDWN  005610          1213   1215#
PWRF1   005572           503   1212#  1472
PWRF2   005602          1147   1214#
PWRRTN  005646          1212*  1214*  1223   1224#
PWRUP   005620          1215   1217#
RETURN  006264           508*  1288   1306*  1313#
SCOPE = 104400           447#   535    548    556    566    581    588    606    616    628    640    648    657
                         670    683    696    712    727    744    763    778    793    811    829    852    867
                         883    897    922    947    996   1041   1064   1086   1103   1118
SCOPEB  006136          1286#  1292   1304   1312
SCOPEC  006150           440   1291#
SCOPEF  006250           506*  1301   1303*  1305*  1308#
SCOPEG  006236          1300   1302   1305#
SEC1    006652          1393#  1480*  1712*  1713   1716*
SEC1A   006672          1401#  1754*  1755   1758*
SEC2    006654          1394#  1481*  1707*  1708   1711*
SEC2A   006674          1402#  1749*  1750   1753*
SETBYT  010140          1594#  1609
SOFTSR= 000176           448#  1877
SP3     006120          1271   1280#
SP3A    006132          1280   1283#
SR      001044           479#   529    745    812    924    997   1181   1195   1228   1246   1291   1299   1492
                        1495   1497   1509   1632*  1854   1870   1877*
START   007412          1490#
SWADJ   011652           489    501   1144   1419   1431   1443   1455   1867#
SWADJ1  011676          1869   1875#
SWDONE  010246          1611   1613   1619#
TABL    010356          1423   1435   1447   1459   1580   1649#
TABL1   010376          1424   1658#
TABL2   010416          1436   1667#
TABL3   010436          1448   1676#
TABL4   010456          1460   1685#
TCSR    001014           466#   986   1122   1125   1157   1171   1189   1202   1275   1316*  1323   1327   1330
TDBR    001012           465#   988*  1121*  1124*  1159*  1173*  1191*  1204*  1277*  1325*  1329*  1332*
TEMP    001020           468#   505*   540*   542   547*   549   550    553*   559*   560*   569*   575*   642*
```

		643	650*	651	659*	660	673*	675	678*	679	686*	688	691*	692
		700*	703*	716*	719*	733*	736*	750*	753*	767*	770*	782*	785*	799*
		802*	817*	820*	836*	837*	842*	843	846	858*	859*	873*	874*	889*
		890*	902*	903*	932*	1007*	1027	1035*	1049*	1074*	1091*	1092*	1107*	1108*
		1244												
TEMP1	001016	467#	507*	898*	909*	1015*	1028	1057*	1082*					
TIKTIK	004246	950*	962	964	980*	984#								
TMPSWR	006702	1405#	1595*	1624*	1627*	1628*	1629*	1632						
TOP	006266	488	498	1222	1235	1281	1316#							
TOP1	006300	1318#	1326	1334										
TOP2	006332	1322	1327#											
TRPA	005204	1128	1134#											
TSTEND	005134	1121#												
TYPE	004250	960	963	986#	987									
T0	001254	508	510	519#	530	532								
T1	001334	524	526	534#										
T10	002226	670#												
T10A	002250	674#	680											
T11	002304	683#												
T11A	002324	687#	693											
T12	002360	696#												
T12A	002410	701#	704											
T12B	002436	702	707#											
T13	002446	712#												
T13A	002476	717#	720											
T13B	002524	718	723#											
T14	002534	727#												
T14A	002572	734#	737											
T14B	002620	735	740#											
T15	002630	729	744#											
T15A	002670	751#	754											
T15B	002716	752	757#											
T16	002726	746	763#											
T16A	002756	768#	771											
T16B	003004	769	774#											
T17	003014	778#												
T17A	003044	783#	786											
T17B	003072	784	789#											
T18	003102	793#												
T18A	003140	800#	803											
T18B	003166	801	806#											
T19	003176	795	811#											
T19A	003236	818#	821											
T19B	003266	819	825#											
T20	003276	813	829#											
T20A	003366	834	842#											
T21	003426	841	852#											
T21A	003512	854	864#											
T22	003522	863	867#											
T22A	003602	869	878#											
T23	003616	877	883#											
T23A	003702	887	894#											
T23AA	003662	890#	891											
T24	003712	897#												
T24A	003744	902#	910											
T24B	003774	899	908#											

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T24C    004010            907    922#
T24D    004076            934    947#
T25     004264            926    977    996#
T25A    004502           1018   1041#
T26     004616           1064#
T27     004740            999   1066   1086#
T27A    005040           1103#
T28     005256           1152#  1161
T28A    005270           1154#  1156
T29     005336           1166#  1175
T29A    005350           1168#  1170
T3      001414            549#   554
T3A     001442            556#
T3B     001504            566#
T30     005456           1188#  1193
T31     005536           1201#  1206
T4      001572            581#
T5      001614            588#
T6      001712            606#
T7      001750            616#
T9      002006            628#
T9A     002052            640#
WAITA   007422           1492#  1500   1513
WAITB   007432           1494#  1507
XOR     001230            492    512#
XORA    006254           1296   1310#
XORFLG  006252            495*   515*   728    794   1065   1178   1293   1309#
XORM    006540            497   1360#
.     = 011714            435#   437#   442#   450#   459#   538    543    551    563    578    585    591    595
                          599    603    609    613    619    623    632    636    646    655    664    676    689
                          708    724    741    758    775    790    807    826    844    847    904   1093   1100
                         1109   1116   1123   1126   1158   1172   1182   1190   1203   1220   1229   1233   1247
                         1276   1319   1324   1328   1331   1336#  1343#  1345#  1359#  1413#  1709   1714   1719
                         1724   1731   1737   1751   1756   1761   1766   1773   1779

. ABS.  011714     000

 ERRORS DETECTED:  0

 CZKWBJ.BIN,CZKWBJ.LST/CRF/SOL/NL:TOC=CZKWBJ.P11
 RUN-TIME: 2 4 .5 SECONDS
 RUN-TIME RATIO: 41/7=5.7
 CORE USED:  9K  (17 PAGES)
```